Household Electricity Consumption and Conservation Practices in Kerala: A Performance Analysis of Kerala State Electricity Board

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DECLARATION

I, RENJISH KUMAR V K., do here by affirms that the work for this Thesis entitled **"HOUSEHOLD ELECTRICITY CONSUMPTION AND CONSERVATION PRACTICES IN KERALA: A PERFORMANCE ANALYSIS OF KERALA STATE ELECTRICITY BOARD"**, being submitted as a part of the requirements for award of the degree of Doctor of Philosophy in Economics of the Department of Economics, University of Calicut, Dr.John Matthai Centre, Thrissur was carried out entirely by myself. I also affirm that it was not part of any other programme of study and has not been submitted to any other University for the award of any Degree.

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Dedicated to My Parents

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ABSTRACT

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Electricity is an indispensable resource for the growth process of an economy. The demand and supply of electricity is enhanced though the developmental activities of an economy. In Kerala, the main channel to allocate the electricity requirements is done by the Kerala State Electricity Board (KSEB). The demand for electricity could not be met by the KSEB and it purchases the electricity from other states at higher prices to fill the demand-supply gap and it causes an increase in the financial burden of the board. The energy saving practices of the households differ with respect to their socio-economic status and the awareness level of conservation practices. Here, the study made an attempt to ensure people's conservation practices and their knowledge about electricity saving methods among KSEB & TCED consumers. The main objectives of the study are to analyse the financial and physical performance of KSEB during 2004-05 to 2014-15, to assess the pricing methods adopted by KSEB, to examine the Household electricity consumption behaviour in Thrissur Corporation and to compare the electric energy conservation practices among households under KSEB & TCED. The study found out that the electricity generation is less than the electricity consumption, so the dependency on external sources to fulfil their requirement is in an increasing pace. The financial performance of KSEB is far from satisfaction and not very attractive over the period of time due to their inability to generate revenue surplus, the commercial losses increased rapidly. Out of total consumption of electricity in the state almost half percentage is being consumed by the household sector and the household consumers in KSEB and TCED have good awareness about the use of CFL and LED lights to reduce the electricity consumption. The local authorities can play a key role in regulating the electricity consumption through the adoption of conservation practices. The present study reveals that TCED consumers could save more electric energy through conservation practices because of higher level of awareness.

Key Words: Financial Performance, Electricity Consumption, Conservation Practices.

1.1 OVERVIEW

Power Sector plays a vital role in all developmental activities in our economy. As noted by the Draft of Fifth five year plan, "Electricity is the most versatile form of energy and provides an important infrastructure for economic development. It is a vital input for industry and agriculture, and is of particular importance to a developing rural sector which needs more power for its agricultural operations, for its small-scale and agro-industries"(International Energy Organization-2012). All sectors of economy need electricity for their common needs as it provides light and fuel to millions of households, industry, agriculture, commerce, all service sectors and so on. Electricity is a major type of energy. Reducing electricity consumption is equivalent to generating it, behaviour of consumers using electricity decides whether they save it or waste it.

There has been considerable expansion in generation capacity during the period of planning in India as would be clear from the fact that the total installed generating capacity rose from only 2,300 MW in 1950 to as high as 1,82,690 MW at the end of 2012. The electricity sector in India had an installed capacity of 271.722 GW as in 2015. Electricity generated rose from 55.8 billion KWh in 1970-71 to as high as 394.5 billion KWh in 2010-11(Planning Commission 2011). During the period from 1990-91 to 2010-11, electricity generated grew at the rate of 5.8 percent per annum and during Twelfth plan period demand for electricity grew at the rate of 6.5 percent per annum. India became the world's third largest producer of electricity in the year 2013 with 4.8 percent global share in electricity generation surpassing Japan and Russia. The one percentage of economic growth requires 0.3 to 0.65 percentage enhancement in the supply of electricity. During the year 2014-15, the per capita electricity consumption in India was 1010 kWh with total electricity consumption (utilities and non utilities) of 938.823 billion kWh. Electric energy consumption in agriculture was recorded highest (18.45%) in 2014-15 among all countries. The per capita electricity consumption is lower compared to many countries despite cheaper electricity in India. At a time when the Kerala State Electricity Board has run an overdraft of about Rs.700 crore and

when the hydel dams in Kerala hold just enough water for producing only 2,200 million units of electricity, the daily power consumption in the State touched an all-time high of 54.67 million units in march 2017.

India has the fifth largest electricity generation capacity in the world; the country is still facing the major power crisis, while most of the villages do not have electricity. Over one third of India's rural population and 6 percentage of urban population had no access to electricity. Of those who did have access to electricity in India, the supply was intermittent and unreliable (Census 2011).

In 2010, Kerala imported 10200MU of electricity from other states; its internal availability was 5828 MU, i.e., the total consumption of the state was 175 percent in excess of its internal availability. Even then, its needs have not been satisfied. Kerala now gets 20 to 21 million units of power daily from the Central pool and purchases five to six million units from traders and through exchange. The crisis the state has been facing is not limited in the fact that it is importing electricity from other states or paying high price for its electricity imports. But, even if it is ready to pay higher rates, it may not be able to get electricity from elsewhere in the ensuring future. There is a paradigm shift-taking place in almost all states in India, especially in the southern states in regard to economic development as everyone assigns priority for industrialization.

Over the last fifty nine years, the Kerala State Electricity Board has grown from a total installed capacity of 109 MW to an installed capacity of 2845 MW and created Transmission and Distribution networks of over 10404 and 272480 circuit kilometers respectively. At present, the Board caters to the needs of over 1 crore consumers spread over the urban and rural areas of the State. This incremental growth in the power system brought several changes in the characteristics of the system. The input cost structure and revenue composition have undergone significant changes. Until the recent past, the hydroelectric plants owned by the Board supplied a major portion of the energy requirement of the state. However, after the circulation of the Forest Conservation Act in 1980, the implementation of new hydroelectric projects had been seriously affected and

more costly thermal energy is to be generated / purchased to meet the increasing demand.

Over the years, the consumption of heavily subsidised domestic sector has been increasing and now, it accounts for approximately 46 percent of the total energy consumed. The peak demand in the state has increased to almost twice the off-peak demand. This forced more investment in the power system to meet the peak demand and purchase of thermal energy from outside the State. But the capacity so created for meeting the peak demand remains under-utilised during the off-peak periods. The Board has been supplying electricity at lowest price in the country for several decades. Because of this the Board had to resort to heavy borrowings to meet the expenses. The Board is to continue to function mainly with service orientation providing infrastructure facility, reliefs and concessions to sectors like industry, agriculture and so on. Now, the State Commission insists upon to perform strictly on commercial considerations.

Kerala which is a state in the southern corner of India depends heavily on electricity for its energy needs. Once a supplier of electricity generated mainly through its hydroelectric projects, now the state has turned to be a borrower of electric power especially in summer. The Pattern of electricity consumption in the state has been unsuccessful in matching the steep increase in electricity consumption with a corresponding increase in production. Since the availability of electricity from outside is scarce and expensive, the state is trying to adopt alternate sources of electricity and make awareness among the households.

Electricity Department of Thrissur Corporation is a licensee and is in the service of distribution of electricity, bought from Kerala State Electricity Board (KSEB), at affordable price to all classes of consumers within the municipal (geographical) limits of old Trichur Muncipality. Thrissur Corporation is unique in that it is the only local body in Kerala which is a distributor of electricity and water, though there is nine other distribution licensees in Kerala.

The study takes into account three major factors related to the issue viz. awareness of the consumers about the extent of their electricity consumption, consumer behaviour in electricity consumption and the usage pattern of the consumers in the case of electric gadgets which consume relatively more electricity.

1.2 Review of Literature

Power sector has been a subject of serious discussion and debate both in academia and policy-making process. The first part shows the theoretical background of the study and the main reason for this is that the power sector has been undergoing radical structural and policy changes for the last two decades all over the world. As a result, there has been lot of formal discussion and scholarly research on the various aspects of reform and performance of power sector across the globe. Though there are a large number of studies available to review the power sector reforms across various countries, it is useful to make references to some studies which are highly relevant to the study area. Therefore, a brief review of some of the relevant studies is under taken in the second part.

The main studies are divided into five sections such as (a) General studies on Electricity consumption (b) studies related to Demand and Supply of power sector in India (c) Studies on Physical and Financial Performance of State Electricity Boards (SEBs) (d) Studies on Electricity pricing policy and Tariff (e) Studies on Electricity Consumption of different states in India:

1.2.1 General studies on Electricity Consumption

The study of consumer expenditure, both in total and in consumption, has always been of major concern to economists. Neo-classical economists see the delivery of individual consumption as the main object of the economic system. Within a capitalist economy, such considerations lead to an examination of the relationship between price and consumption behaviour and theoretical development and empirical analysis has been a major continuous activity since the middle of the last country.

In the last fifty years, aggregate household consumption has become as much as an object of attention as has its composition, and in spite of a common theoretical structure, there has been a considerable division of labour between micro economists, interested in aggregate consumption and saving and micro economists whose main concern has been with composition, and with the study of the effects of relative prices on demand. Since the 1930's there has been a continuous flow of theoretical and empirical developments in consumption function research, and some of the outstanding scientific achievements in economics have been in the field. Rajendra, et. al. (2013) pointed out that power is considered to be a pioneer of infrastructure and a part and parcel of human life. Power is a heart of all kinds of economic activities. It is impossible to assume the world without electric power and it is inevitable for economic development. India is the 4^{th} largest country in the world in installed capacity of the power and is in 5^{th} place in power production and is the 6^{th} largest country in power consumption.

Economists were more optimistic than others on the response of aggregate energy demand to a change in its relative price. Most studies found that while energy demand was responsive to price, it tended to be price inelastic, even in the long run. During the late 1970's, many estimates placed the price elasticity of aggregate energy in the -0.3 to -0.7 range when measured at the wholesale level (Energy Modeling Forum, 1982). The oil price collapse in 1986, as well as a more modest price decline in 1983, is providing another real world experiment for testing the symmetry of energy demand responses to rising and falling prices. Price elasticity at the end-use level could be some 50 percent higher due to differences between end-use and wholesale price levels. Elasticities for individual fuels would be higher, reflecting the potential for inter fuel substitution within aggregate energy.

Energy has a derived demand that depends upon the mix of final goods and services desired by households and firms. Electricity is the major type of energy sources the major part of the electricity consumed by the residential sector, households are viewed as combining energy-using capital stock and energy inputs

to produce service flows that provide utility to do decision maker. This approach provides a clear distinction between short and long-run energy demand responses. Working with a fixed capital stock, agents can after their rate of utilization to changes in price, income and weather in the short run. In the long run, the demand for energy is tantamount to the demand for energy-using capital stock. The development of reliable capital stock estimates for empirical application is a decidedly more complex issue. Usually researchers have serious reservations about the quality of such estimates and seek way to avoid them. Their recourse is to represent implicitly the capital stock adjustment by eliminating the capital stock variable in the theoretical model. The flow-adjustment model (Houthakker and Taylor, 1966, 1970) is a tractable way for separating the short and long energy demand responses in the absence of explicit capital stock estimates and it has been applied most successfully to the study of the demand for gasoline in the transportation sector (Sweeney, 1979), where information on the planned fuel efficiencies of different makes and vintages of passenger car is available. This approach has been applied with somewhat less success to the residential sector. Some US studies have used state-level estimates of energy-using appliance over time (Taylor et al., 1982), while others have employed household survey (Cowing and McFadden, 1984) to provide a cross-sectional view of appliance ownership. Industrial energy demand appears to be particularly influenced by the significant shift in economic structure from more to less energy intensive sectors. At least one-third of the reduction in fossil fuel use per dollar of output may be due to the compositional shift in output in this sector. The sources of shift are uncertain and require additional research; energy prices, the cost of capital, capital obsolescence, the business cycle, technological change, and the appreciating dollar have all been mentioned as potential contributing factors.

Taylor (1975) studied some ambiguity has arisen about the price variable in energy demand studies as well. The frequent use of export average prices introduces simultaneity biases because this price variable is determined and natural gas are sold on a declining block basis, in which the marginal price falls as consumption increases. The substitution of marginal for average price may be

insufficient to capture adequately the full effects of rate schedules on fuel demand. Marginal prices will reflect changes in the slope of the budget line for households, but the budget line itself can be shifted inward by an increase in the fixed charge. This consideration would argue, at least conceptually. For the inclusion of both marginal and fixed charges in demand studies for such fuels fuel availability can be an important issue in some demand studies. Not all households in the US have had access to natural gas pipelines, even when price controls were not binding. This access problem affects the demand for substitutes (eg. Fuel oil and Electricity) as well as for the fuel itself moreover, price regulations have had similar distorting effects. Blattenberger et. al., (1983) Binding price regulations have prevented the estimation of the demand for natural gas during the 1970s in the US. Natural gas shortages have also induced greater demand for substitute fuels than would be the case if all markets were clearing. For the most part, these issues have been insufficiently analysed in traditional demand studies.

The price elasticity of aggregate energy demand measures the proportional change in the aggregate price of energy. It is closely akin to the concept of the elasticity of substitution between energy and non-energy inputs. If the supplies of non-energy inputs are held fixed, the aggregate elasticity will shape the long run, energy-economy linkage. Energy's relatively low historical value share of GNP may not be an appropriate indicator of energy's importance to the economy, if limited flexibility in substituting capital and labour for energy greatly influence the future value share of energy (Hogan and Manne, 1977). A higher elasticity implies less economic loss resulting from a reduction in energy availability or from a change in the cost of imported energy. However, if energy costs are raised by a domestic tax on energy that keeps the higher energy expenditures within the country the economic loss becomes greater as the aggregate elasticity increases.

1.2.2 Demand and Supply of Power sector in India

In 2016-17, the energy availability was 1,135.334 billion kWh with a short fall of requirement by 7.595 billion kWh (-0.7%) against the 1.1 percent surplus anticipated. The peak load met was 156,934 MW with a short fall of requirement

by 2,608 MW (-1.6%) against the 2.6 percent surplus anticipated (CEA). Of the 1.4 billion people in the world who have no access to electricity, India accounts for over 300 million, some 50 million homes. The International Energy Agency estimates that India will add between 600 GW to 1,200 GW of additional power generation capacity before 2050 (IEA).

The study on demand and supply gap in energy in Kerala pointed out that the gap has been growing at an exponential rate. The situation took a worse turn beyond 1986 when 'Blackout' and 'Brownout' become regular phenomena in the state (Pavithran, 1991). The observed reasons for power shortages in Kerala are that the energy policy of the central government, the stand of environmental fundamentalists, the cost overrun and time overrun of Hydel projects, corruption in the project construction and lack of central investment in the power sector in Kerala. This is responsible for the present power crisis in the state (Unnikrishnan, 1996).

The gap between the energy and peaking demand in Kerala can only be more on account of consumption pattern of the electricity and the increasing requirement of domestic and commercial load. Kerala had 100 percent generation from Hydel projects and it was able to generate and supply power at the lowest rates possible in the country. The industrial sector of the state has not grown significantly since the mid sixties. The share of the manufacturing sector in the state domestic product is small. The poor performance of the power sector during nineties and non-availability of power and its poor quality had been considered major barriers against faster industrialization of the state. The opposition from the environmentalists against large hydropower projects is also a reason for the failure of tapping the state. In this context, the best opportunity available is the development of the best environmental friendly source, i.e., the small hydro power (Unnithan, 2003).

Electric power has become an inevitable ingredient in every day human life and a universal input for economic growth. With steadily growing population, increasing urbanization and rapid diversification of the economies, the demand for

power has been increasing unprecedentedly the world over. However, most third world economies including India has been suffering from chronic power cuts, and load shedding. This in turn has slow down the tempo of economic activities and caused disruptions to normal life of the people (Pavithran, 2005).

According to the Central Electricity Authority (CEA) the Electricity demand in the country will grow at 7 percent (CAGR) between financial year 2017 and 2022 and then slow down to 6 percent in the subsequent five years. Demand for electricity had grown at a much lower pace than projected by the CEA in the last five years with slow industrial production growth; peak demand grew just 4 percent in 2016-17 to close to 160 GW against the CEA's estimate of 9.3 percent growth. The CEA's latest survey projects that the industrial sector will lose its relative share in power consumption in the next 10 years, while the domestic sector will increase its share to become the largest consumer segment.

The power generation and availability are important determinants of the pace of industrial growth in recent years; shortages in their availability have acted as a major bottleneck towards fuller utilization of the industrial potential of the country. Navroz (2001) has made a serious attempt to survey the current power generation and consumption position in India, and to assess the likely changes over after 1990. This takes the form, at a macro level of an examination of the efforts made to develop the power sector in the five year plans; and at a micro level, of a detailed study on a state by state basis of such factors as the progress made in the implementation of projects, trends in demand, targets set by state governments for rural electrification schemes, and plans for the installation of new capacities.

The concept of Integrated Resource Planning (IRP) the power sector minimizes the environmental impacts of electricity generation (Anuradha 2006). Apart from this, the concept also deals with the supply side and the demand side resources unlike the traditional planning process in the power sector. The scope of IRP in developing countries is limited by various factors and what could be the same are all discussed with in the limited scope of the paper. The cost constraint is

the most powerful constraint as far as the developing countries are concerned. The paper ultimately concludes that in order to start the IRP successfully around the globe developing countries must practice regional integrated resource planning, that is cost effective (Remesh 1990) analysis the impact of power shortage on the industrial sector and observed that power shortage in the industrial sector may lead to captive power generation.

According to Mitani (1997), energy saving occurs either by improving the energy conservation process or by recycling the desecrate materials. Enhancing energy conservation measures will not only help in saving energy supply constraints, but also help in tackling environmental problems. Handi Banbi (1998) opines that the creation of supply structure between various economies of developing and developed countries will make it possible to consolidate links and make a favourable atmosphere of interrelated developed plans.

Mary (2006) found that electricity is one of the key inputs for socio-economic development. It contributes to poverty reduction by fuelling economic growth and enabling the fulfilment of the basic human needs of health and education. Provision of electricity is thus crucial for social welfare of the people. To reduce the demand-supply gap for electricity different models for reforming the power sector have been adopted across the developing world. Following a decade of reforms, it is appropriate to ask as to what extent these reforms have benefited the poor. In this context the author has critically examined the impact of reform processes adapted in selected states in India and in Philippines on access to electricity by the poor. In India, reforms were aimed to improve financial viability of the ailing power sector than on improving access to electricity. The legislation does not explicitly spell out the provisions for the extension of electricity service to the poor and the need and mechanism for subsidizing marginalized consumers.

Accessibility to affordable and reliable energy is a must for production process and is indispensible for maintaining the growth momentum of an economy (Mukherjee 2012). Focusing on the importance of energy for development, with a discussion on global energy outlook with special reference to Asia and two of its

fastest emerging nations; India and China starting from a macro point of view with the analysis of demand for energy across different regions of the world, the paper has made a micro level discussion on energy imperatives for energy situation on regional development. (Sharma 2012) also pointed out that a realistic electricity demand projection is crucial in the context of the overall development of the power sector because the same is intended to be used by the electricity companies as a reference. An exaggerated demand projection can lead to excess generation capacity and would add to the associated thorny issues that come along with it.

Ashok V Desai (1987) found that the electric power systems in a number of industrial countries experienced large increase in costs, a slowdown in the growth of demand and the emergence of surplus capacity after the 1973 oil crisis. It is almost as if the Indian power system belonged to another world. While it also shared in the inflation that ensued, it was virtually untouched by the rise in oil prices because its dependence on oil was negligible. It faced chronic excess demand, which it could not satisfy despite an extraordinarily high rate of growth of output it could forget about efficiency and profit, and concentrate on breathless growth.

1.2.3 Physical and Financial Performance of State Electricity Boards

Due to high indivisibility of service and existence of economies of scale, Electricity Supply Industry was treated as a natural monopoly all over the world. It was designed as an integrated system and generally a single entity was created which was responsible for the generation, transmission & distribution of power. In most of the countries, the electricity supply industry has been established and operated under public ownership. Because of imperfect competitive nature of the industry, privatization was not preferred. Until the beginning of 1990s, the Electricity Supply Industry (ESI) was developed as integrated system under the public ownership in most of the countries. In India also, the ESI was designed as an integrated system combining the functions of generation, transmission, and distribution of power. State Electricity Boards (SEBs) were constituted under the

provisions of The Electricity Supply Act 1948. Until the initiation of power sector reforms in mid 90s, the industry remained in a monopolistic market structure under the public ownership. Until the initiation of power sector reforms, the journey of fifty years (from 1948 to 1998) showed impressive physical growth in terms of installed capacity and network expansions. There are many official as well as independent studies which show that the physical growth of the power sector was significantly high. For example per capita consumption of power in India increased from 50 kWh in 1947-48 to 500 units in 1998-99, 779 in 2009-10, 918 kWh in 2013-14 and 1010kWh in 2016-17 (Central Electricity Authority 2018). However, the operational and financial performance of most of the SEBs was not satisfactory. The transmission and distribution losses were reported at very high levels. The main reason for poor operational performance was the lack of organizational autonomy and commercial outlook in the operation of SEBs. Some studies have highlighted various problems faced by SEB's in relation to their financial performance & pricing policies. Some recent studies also examined the role of State Electricity Regulatory Commissions (SERC's) in improving the financial performance of the respective electricity distribution companies.

In India, power is generated mainly by thermal, hydro and nuclear stations. Energy requirement in India are met from both conventional and non conventional sources. Generation of power in India is done mostly by government sector entities, and is controlled by various central public sector corporations, like National Hydroelectric Power Corporation, National Thermal Power Corporation and various state Electricity Boards (SEB's) and Electricity Departments. The transmission and distribution is done by the SEBs, Electricity Departments or private companies.

During the post independence period, the various states played a predominant role in the power development. Most of the states have established State Electricity Boards. In some of these state separate corporations have also been established to install and operate generation facilities. In the rest of the smaller states and UTs the power systems are managed and operated by the

respective electricity departments. In 1991, the Government of India announced the policy of liberalization and consequent amendments in Electricity (supply) Act which has opened new vistas to involve private efforts and investments in electricity industry. Considerable emphasis has been placed on attracting private investment and the major policy changes have been announced by Government in this regard. The Electricity Act, 1948 was amended in 1991 to provide for creation of private generating companies for setting up power generating facilities and selling the power in bulk to the grid or other power consumers. This initiative widened the scope for private investment in the electricity sector by introducing certain financial, administrative, structural, regulatory and legal reforms and modifications. But private participation was encouraged only in generation, protecting SEBs from competition.

Electricity plays a prominent role in national life and it is a vital input to both industry as well as agriculture. Utmost attention should be paid towards the financial liabilities of State Electricity Boards (SEBs). A formidable factor that threatens the very survival of SEBs is the unremunerative tariff for which the cardinal principle should be that no single unit of power should be sold at less than the cost which should include the cost of expenditure on generation plus depreciation of assets (Mohan 1987). The government should come forward to give appropriate subsidy where boards incur losses while achieving socio-economic objectives. The government can also explore the ground for participation of private sector and making joint investment in the power sector so as to pool all available resources. It will not only relieve the industries groaning under the impact of endemic power shortages resulting in heavy loss in production, but would drastically curtail the crushing burden of heavy oil imports also. His study covers in its ambit the whole range of issues, viz, constitutional status of electricity, organisation and working of SEBs, administrative hierarchy, industrial relations, consumer's satisfaction, financial, material and personal management as well as Indian Electricity (Amendment) Act, 1986 and impact of Chernobyl accident on India's nuclear power policy.

Cronwell, Schmidt and Sickles (1990) studied the estimation of production and cost functions with using panel data developed the methodology for efficient estimation of these models applied it to the case of US Airlines. They used the CSS methodology to estimate State Electricity Boards specific technical efficiency over the period 1976-77 to 1985-86. They used within, Generalized Least Squares (GLS), and Efficient Instrument Variables (Eff IV) estimation procedures. [For reasons discussed by CSS, the Eff IV methodology is likely to produce the most efficient results. An advantage of the CSS methodology is that the exogeneity assumptions of Eff IV and GLS methodology are testable]. The results indicate that there are diseconomies of scale in the production of electricity. The analysis of technical efficiency by SEB reveals that these SEBs have been remiss in the area of technical efficiency. Thus productivity in these SEBs has stagnated overtime. Indeed there is some evidence of technological regress. Further this result appears to be true of all State Electricity Boards (Jha, Murty et al. 1992). The performance of various State Electricity Boards was an urgent need to take appropriate steps to improve the operational as well as financial performance of the State Electricity Boards. Parikh, Painuly and Bhattacharya (1996) tried to analyse the performance of the State Electricity Boards in India by examining the technical as well as financial aspects of the power sector. It highlights that in the pre-reforms period, operational performance of the power plants of SEBs was inefficient. Some improvements were reported in the Plant Load Factor (PLF) after the introduction of medium size gas based power plants (200 MW to 500 MW) (Rao 1996). His study did not observe any remarkable progress in initiating the renovation and modernization programmes in the pre-reform period. The study also highlighted some issues on the poor efficiency of the SEBs in supplying electricity. It revealed that poor commercial outlook was the main reason, which was responsible for deteriorating financial performance of the SEBs. The pricing policy followed by State Electricity Boards was not consistent with the principles of economic efficiency. It contributed to inflate the demand for electricity and resulted in the irrational use of power (Amerjeet 1998).

Ghose Nilabja (1998) tried examines the economic benefit of subsidy available to farmers. It was observed that in majority these were large size farmers who were taking the actual benefit of the power subsidy. Small farmers were using only a fraction of total power supply to the agriculture sector. All this was happening just because of political interventions. So, there was an urgent need to mitigate the political interventions in the decision-making process of the SEBs.

Govinda Rao (1998) made an evaluation of the financial performance of SEBs in the country. The study had examined the technical and financial performance of all SEBs for the period from 1980-81 to 1994-95. This study used the secondary sources of data available from various sources such as Planning Commission's Annual Report on the Working of State Electricity Board and Reports on Energy published by Centre for Monitoring Indian Economy (CMIE). To measure the technical performance, Plant Load Factor (PLF), Transmission and Distribution losses (T&D losses), electricity consumption were taken as performance indicators. Various components of cost of supply such as cost of power purchase, average cost of supply, average tariff, etc. have been measured as indicators of financial performance. The study concludes that the technical and financial performance was very poor for the period of study. Some of the states could not achieve the target of rural electrification. The access of the rural people to the network was just 6 percent in Bihar and 11percent in Uttar Pradesh in FY 1994-95. The study suggested that there was an urgent need to initiate power sector reforms to improve the technical and financial performance of SEBs. At the state levels, rationalisation of electricity tariff should be initiated at the earliest. Further, the subsidy to be paid on part of respective state governments should be adequate to cover the revenue gap of the SEBs.

The tariff needs to be linked with the level of economic efficiency in consumption. Sebastian Morris (2000) expressed that true reform and restructuring of any state electricity board in India would have to address the issue of an enormous leakage of revenue from the system. This would call for privatization of distribution, and change in the institutional mechanism, for the administration of

the subsidy. Rather than the detailed regulatory mechanisms, which are being pushed by the central government and the regulators, light and price-cap type regulation would suit India better. A model plan for change is put forward for the Gujarat State Electricity Board, which is quite general and could easily apply to other SEBs. A complete separation of distribution from generation is neither necessary nor desirable; existing IPP contracts would have to be extinguished and methods to carry out the same are suggested. The danger of mounting regulatory risk is either shutting out private power production, or resulting in massive tariff increases.

Rao Govinda, et al (1998) highlighted various commercial aspects of the State Electricity Boards in India. This study reviewed the existing pricing policy and its impacts on the SEB's financial position. In the study, the data was analysed using various parameters such as average cost of supply and average revenue realized from various consumer categories. It concluded that the due to the lack of operational efficiencies and organizational problems, there was no incentive to SEBs to improve the technical and financial performance. It further added that there were many evidences when political considerations played important role in day-to-day management as well as making decision on setting prices in the electricity sector. The electricity tariff for some consumer categories was too low to cover the cost of power. Consequently, it adversely affected the financial health of most of the SEBs in the country. Some of the consumer categories were charged significantly lower than the cost of supply. The tariff structure was based on the historic cost of assets. It led to wastage of energy across various sectors. The tariff should reflect the social cost of supplying power without providing undue advantages to the political interventions in the decision-making process on tariff and related issue.

The restructuring has been driven by ideological considerations in some developed countries and by a fiscal crisis and power shortages. It has usually succeeded in increasing supply and stabilising or reducing prices. Indian experiments with reform have found consumers willing to pay economic prices for

power (Anil 2000). He mainly focussed on Distribution, Employee problems and problem of rural electricity supply. Distribution has been the weakest link in Indian ESI. It is acknowledged that the official statistics of Transmission and Distribution losses, (22-23%), is a gross understatement of the actual loss in some SEBs, being well over 40-45 percent. A large part of the loss trend to be passed off as agricultural consumption, employee resistance is one of the major issue in India. All the states undertaking restructuring have faced agitation by SEB employees. But when confronted with political determination of the state government of Indian exercise has been that it gives full protection to the jobs of existing employees. This was a practical necessity in the Indian context, as it does not have a safety net unlike in the western countries. The problem of rural electricity supply is one genuine concern in this exercise. Unlike the western countries where this accounts for a very small fraction of total consumption, in India it is a major component. It is also major political issue compared to say, the UK or the US. The basic objective of the 1948 Electricity supply Act was to extend the benefits of electricity to semi urban and rural areas.

Power sector policy in India appears to have locked itself into adverse arrangements at least twice before 2000. The first was when agricultural consumption was de-metered and extensive subsidies were offered; the second when Independent Power Producer contracts with major fiscal implications were signed by the State Electricity Boards (Dubash 2001). A third set of circumstances, with the potential for equally powerful forms of institutional lock-in, appeared with the reproduction of the Orissa model on the national scale. While a state-led power sector has been responsible for substantial failures, is the design of the reformed sector well aimed at balancing efficiency and profit-making on the one hand and the public interest on the other, The discussion of the forces and actors that have shaped the reform processes is intended to contribute to an understanding of how the public interest can best be served in the ongoing effort to reshape the power sector.

The role of regulatory commission was examined taking the issue of accountability as the major plank. It was pointed out that the main problem with

erstwhile SEBs was accountability. There was excessive interference in the functioning of SEBs on behalf of state governments. This was the main reason for the poor technical and financial performance of the SEBs (Prayas, Pune 2001). The operational performance was also one of the major reasons responsible for poor financial performance. The poor financial position of SEBs led them into financial bankruptcy. Consequently, they were unable to pay the input suppliers and national generation companies. SEBs also failed to fulfil their short-run as well as long-run capital requirements. It was further argued that subsidies made available to agricultural and domestic consumers have increased mainly due to political decisions (Joel 2002).

The weakness of the Indian power reforms programme has been that while it has focused on sorting out distortions in the relationship between the owner government and power utilities through the unbundling and regulation model, it has failed to carry credible assurances that this will improve the equation between the reformed utilities and their consumers (Sumir 2005). The Punjab state Government should not undertake the reforms under the undue pressures put by various global agencies such as World Bank. The Government should focus on the improving the operational efficiencies. It should try to improve the operational and financial performance of the State Electricity Board (Jain 2004).

The major challenges of the power sector are to continue with the reform, to improve the financial health of the utilities, to enable competition and acceleration of economic growth, while protecting the environment and mainly to raise significantly the comfort level of the common man by making available quality power at reasonable price (Verma 2004).

Sidharth (2005) suggested two steps which are necessary for introducing competition in the power sector. First there should be a physical and organizational separation of agricultural and rural supply, second cross subsidy in tariffs should be eliminated for urban domestic consumers and replaced with life line rates for low income consumers and subsidized attention of the network to high cost areas. As in the case of telecommunication this may be funded through sector specific ‘universal charge’. Moreover open access and multiple distribution

licensees are two key provisions in the Electricity Act 2003 for introducing competition in the power sector.

Jayasanker et. al 2000 in their study shows that KSEB's solvency and creditworthiness will be undermined to a critical point if its financial performance does not improve over the next couple of years. The restructuring of Kerala State Electricity Board's financial viability has to be addressed at different levels through a series of practical measures in order to limit the tariff increase to socially acceptable levels, while ensuring a sustainable solution to Kerala power sector. A study to evaluate the financial performance of Maharashtra State Electricity Board (MSEB), Anjana and Parikh examined the pricing policy followed by Maharashtra State Electricity Board. The tariff structure was highly skewed across various categories of consumers. Agriculture sector and Domestic sector are charged at very low tariff rates. It was suggested that the tariff should be based on the cost of power supply (2000). The state government should pay adequate subsidy to the Board to compensate its revenue gap on account of power supply to agriculture sector.

The role of Haryana Electricity Regulatory Commission (HERC) in promoting the transparency, accountability, and public participation in the decision-making process was examined by Rajesh et. al.(2005). He was observed, after the constitution of HERC, the scope for transparent and participatory decision-making process had increased. However because of the lack of awareness among consumers, the public participation in the regulatory process was not very effective. The technical and financial performance of Punjab State Electricity Board (PSEB) highlighted some of the inefficiencies in the operation of the electricity generation, transmission and distribution functions in Punjab. It stated that PSEB has been incurring high energy losses. Despite the restructuring process being initiated at the state level, no adequate measures were taken to improve the financial performance of the Board. Because of highly subsidised electricity tariff, PSEB was unable to generate the adequate revenue to recover the cost of power supply (Singh, Kulwant 2006).

The effectiveness of the power sector reforms initiated in the state of Orissa was analysed by Sinha and Sidharth (2003). The main objectives of the study were to review the outcomes of electricity reforms and draw lessons for other states that are in the process of restricting of power sector. The Government of Orissa such as unbundling and privatisation of Orissa State Electricity Board have been highlighted. The study has used the information available from the annual revenue reports of the companies and tariff orders issued by Orissa Electricity Regulatory Commission (OERC). The study pointed out that even after privatisation of distribution business there was no improvement in the technical performance of the distribution companies. Another study of power sector reforms in Andhra Pradesh was made to assess the impacts of electricity sector reforms in Andhra Pradesh (Pani, Saranga 2007). Here an attempt was made to evaluate the operational performance of generation as well as distribution segments after the power sector reforms process initiated in the state. The proposals of Annual Revenue Requirement (ARR) and the Tariff Order issued by Andhra Pradesh Electricity Regulatory Commission (APERC) were used as main data sources for the study. It was concluded that the reforms had led to a neglect of capacity addition programmes in the state sector.

The physical and financial performance of various State Electricity Boards in India was analysed in the pre-reforms period from 1970-71 to 1997-98. The issues related to installed generation capacity to technical efficiency, T & D losses and some aspects of institutional and organizational efficiency were examined. The financial performance was measured by comparing the average revenue realised to the cost of supplying power to various categories of consumers. The study was designed for making a comparative analysis of various SEBs in India (Kannan and Pillai (2001). It was pointed out that on an average, the country made a significant progress in installing new generating capacity. However, in some of the states, the capacity addition initiatives were inadequate. The Plant Load Factor (PLF) and Plant Availability Factor (PAF) were reported at very low levels (PAV). In some states, the PLF was below 50 percent. The T& D losses were estimated to be in the range of 20 and 30 percent for most of the SEBs. Ramappa (2013) suggested that

in order to improve the performance of power sector ongoing hydro power projects are to be completed timely to enhance the supply of hydro power. Plant load factor is low in thermal power plants will be utilized fully. This in turn helps to generate additional thermal power. In the country as a whole the T & D losses showed declining trend after 2002-03. But in some states like J&K and Bihar the percentage of T & D losses is high. Hence there is need for reducing T & D losses. Power theft must be controlled in order to improve the revenue position of power sector. Apart from these measures, the generation of non conventional energy must be increased in order to reduce the gap between the supply of and demand for power.

1.2.4 Electricity Pricing Policy and Tariff

Sarkar and Kodekadi (1998) made an attempt to formulate a macro economic model to assess the impact of energy price changing on crucial variables such as growth, inflation, payment of income distribution etc. It was observed that the price changes had a significant impact on these variables. So the frequent changes in the tariff for electricity should be avoided.

The electricity bill 2001 is a step forward in removing the anomalies, inconsistencies and even contradictions in and between existing laws pertaining to the power sector. But it fails to impose deterrent punishments for failures on matters ranging from theft and quality to payment of bills by distributing companies. It has provisions which will violate the transparent functioning of regulatory commissions (Rao 2001). While the bill will enable the creation of markets, facilitate the process of private investment in transmission; improve grid discipline and ease some what the working of the regulatory commissions' success in improving the supply and quality of electricity and the financial performance of the power sector, In the ultimate analysis on the speed with which the state electricity boards can be made financially viable. It is found that the electricity is priced quite lower than the costs of service to farmers and domestic consumers in various states. Rao (2002) further argued that though some multilateral lending

agencies are pushing the power sector restructuring process in the name of expert advice and support to the country.

The current focus on rural electrification is unlikely to resolve the energy access problem due to low penetration of electricity in the energy mix of the poor (Ailawadi 2006). He also argues that strategies based on energy market reform, promotion of renewable technologies and correct price signals are unlikely to succeed in changing the situation as acceptance of this policy prescription is rather low. Instead, a bottom-up, holistic long-term approach is suggested that integrates energy access with economic development, and relies on selective market intervention, local resources and local governance. The article "Reform in the India Power Sector" observes state that power is the engine of a country which likes to travel journey towards development. An economy can never reach it self-reliance without a proper functioning of the power sector. The significance of power sector accelerated with the popularization of the concept of globalization. Globalization motivated many developing countries to proceed along the path of reforms in order to achieve positive structural changing dynamics along the path of development, India adopted a number of reforms right from the financial sector to the infrastructure sector (Bhattacharya 2006).

Varinder Jain (2006) highlighted some issues on the pricing policy being followed in the Punjab power sector were highlighted. It was stated that the existing policy on electricity subsidy was not consistent with the principles of equity and efficiency. The subsidy was available on open ended basis without ensuring proper rationing of the energy. Rajasekhar (2003) study on the basis of a sample survey conducted for 300 farmers, it was concluded that most of the small farmers were not able to utilise the benefits of subsidy. Economic growth and industrialization are contingent upon the adequate availability of energy. The level of technology of a country and its rate of development hinge upon the nature are sources of available energy.

The pricing policy of various electricity regulation commissions in India was analysed by Ahluwalia Sanjeev (2000). He observed that most of the regulatory

commissions had followed the cost of service methodology for the purpose of determining electricity tariff for electricity consumers. The cost of service methodology was not an appropriate method in the Indian context. Since most of the power supply to agriculture sector was un-metered, therefore, it was not possible to estimate the actual cost of electricity supply. Moreover, under the cost of service method, the utilities have a tendency to overestimate the cost of service. So, this method would not be suitable for India in the process of tariff determination. The average revenue received from agricultural and domestic consumer categories was very low in relation to the cost of service. Kumar, Surinder (1985) suggested that the subsidisation should be based on social cost-benefit analysis. The tariff making process should be completely depoliticised. If any category of consumers such as agriculture needs to be subsidized, the respective state government should pay full subvention for the subsidised supply of electricity to that consumer category.

Prasad (1970) the statistics of load factor and utilization factor for the power systems in different states, in both agriculture and industry, widespread and underutilization of capacity created by the consumers to use electricity and he also suggested that two part tariff structure can be evolved which will improve not only the load factor but also the demand factor. In agriculture, a suitable minimum guarantee charge for electricity is likely to lead to community utilization of equipment such as for lift irrigation. This will encourage installation of a network of lift irrigation schemes by co-operatives and may result in the pooling of resources of small cultivators enabling them to drive the benefits of rural electrification which have been denied to them so far. In industry, a minimum guarantee charge will be resisted on the ground that the higher cost of electricity will raise overall cost of production. But this argument is baseless since, except for a few industries like aluminium, cold storage and inorganic heavy chemicals, electricity is not a significant item in the cost structure.

The study of pricing policy in public utilities in the power sector found that the SEBs did not enjoy any autonomy; its pricing policy was not based on any

rational economic principles Surinder (1984). The technical and financial performance of SEBs was very poor. The decision making process of SEBs, particularly the tariff setting process was manipulated by unwanted interferences on part of the respective state governments. SEBs were forced to provide electricity either free of cost or at the rates significantly lower than cost of supply to specific consumers‟ categories without socio economic justification. Further, there was also huge cross subsidisation. Cross-subsidisation means that some consumer categories such as domestic and agricultural were being charged at lower rates than the cost of electricity supply, whereas others (industrial and commercial) were paying tariff higher than the cost of supply. The cross subsidisation from industrial and commercial sectors was used as a means to reduce the losses, incurred by SEBs. Further, the study has suggested that pricing policy should be based on sound economic principles. Surinder (1988) observed that currently there was high cross subsidisation in power sector. Some consumer categories such as agricultural and domestic users were charged below the cost of supply. While other users such as commercial and industrial consumers were required to generate a revenue surplus. Heavy cross-subsidisation was not a good practice because it may promote wasteful use of power. On the other hand, excess paying consumers have started shifting to captive power generation. Apart from the higher tariff applicable to industrial users, poor quality of service was the main reason that promoted captive generation. This way, the ability of SEBs to generate additional revenue from industrial users decreased significantly. Thus, the policy of cross subsidisation has resulted into heavy losses to the SEBs.

1.2.5 Electricity Consumption of different states in India

Electricity consumption has been increasing at a fast rate in agriculture when compared to other sectors namely industrial and domestic sectors. Growth of electricity consumption is much higher than the growth of area underground water as well as electric pump set. Rapid increase of electricity consumption in agriculture is mainly because of increase in per pump set consumption and not merely because of more number of electric pump sets (Narayanamoorthy 1999).

The study follows trends and determinants of consumption of electricity for agriculture in Kerala the period from 1960-61 to 1992-93 both at the national as well as at the state level. The study suggests that since the relationship between the area underground water and the consumption of electricity is highly positive, it is possible to increase the efficiency in the use of electricity by regulating the exploitation of groundwater.

Abey George (2000) the study identified the major factors for the vulnerable electricity generation system in Kerala and these factors are namely high levels of transmission and distribution losses, increasing domestic consumption by a few, subsidized supply of electricity to the industrial and the tourism sector, decreasing capacity of reservoirs and the unreliability of Monsoons. The KSEB's answers to this very complex issue were rather simple viz., depends on fossil fuel based electricity generation system. Three of these are already operational and another five are in the pipeline including both public and private sector undertakings. Kerala has been looking for many options to meet the demand for power from non-hydro sources such as coal, diesel etc. The coal bearing regions being situated far from the state, it may be not economically viable to operate coal-based systems. It is not easy to find locations for coal based thousand MW power stations anywhere near the sensitive coastline or within the densely populated midlands. However the state has decided to go in for non-hydro option. Nair (2000) the study gave a brief introduction of the basic features on India's energy consumption patterns and then deals with the special characteristics of power infrastructure taking up the detailed examination of the main problems facing the power infrastructure, method of estimating demand, trends of capacity expansion and forecasts etc... India's electricity sector will have an increasing share of the commercial energy usage

The demand for electricity is predicted to grow at an average annual rate of 5.9 percent between 1999 and 2020 significantly above the 3.3 percent world average. Through the use of co-integration techniques it is found that the long run income elasticity and long run price elasticity of demand were 1.1 and 1.3

respectively (Chenng and Thomson 2001). The error correlation model shows that there existed bidirectional causality between the GDP and electricity consumption and the causality between energy consumption and economic growth by using India data for the period 1950-1996. Paul and Battacharya (2003) Applying Engle Granger co-integration approach combined with the standard Granger Causality test, they find that bidirectional causality exists between energy consumption and economic growth. Further they apply Johnsen Multivariate co-integration Technique on the different set of variables. The study finds that energy consumption, economic growth, capital, labour are co-integrated. Using Granger Causality test and Dickey Fuller test the study examined the causal nexus between energy consumption and economic growth and stationarity of the time series by considering the variables such as per capita state domestic product (at 1980-81 prices) and per capita electricity consumption between 1970-71 and 1999-00. The study found that the possible reasons for an independent relation between the two are over subsidization of power in agriculture and household sector, Transmission and Distribution losses and power theft by the consumers etc... (Shambhat, Tripura sundari and Bincy 2004).

Seung, Lee (2010) suggests that electricity has been the foundation of economic growth, and constitutes one of the vital infrastructural inputs in socio economic development. The world faces a surge in demand for electricity that is driven by such powerful forces as population growth, extensive urbanization, industrialization and the rise in the standard of living. He also examined to ascertain whether there is a systematic relationship between electricity consumption and economic growth. A statistically significant inverted U-shaped relationship between per- capita consumption of electricity and per-capita income is detected. Energy is a major constraint in the growth of developing countries and hence makes out a strong case for adequate investment in the power sector (Tyner 1978). He observed correspondence between energy consumption and national income, implies that inadequate energy supplies would hamper economic growth and adequate energy supply is a crucial prerequisite for sustained economic growth. An attempt for the estimation of marginal cost pricing for electricity

undertakings in India was made using average incremental cost method. After estimating marginal cost prices, it is compared with the prevalent electricity tariffs and it concluded that the marginal cost approach of pricing is the more appropriate method in ensuring price stability (Gellerson 1980). Under this method, it is ensured that the generation capacity is fully utilised. It further concluded because of differences in the technologies used, the marginal cost of energy was higher in the northern as well as southern regions in relation to eastern as well as western regions. Pillai (1981) examined supply and demand aspect of the Kerala Power system during 1957-58 to 1976-77, using econometric techniques. The major findings of the study include aggregate demand for electricity consumption grew at an annual compounded rate of 10.4 percent during the period 1957-76. The price elasticities of demand in the short and long run are estimated as -0.633 and -0.813 respectively. The income elasticity of demand for elasticity in Kerala has been much higher than those prevailing in other developed countries like USA, USSR, UK, France and West Germany, but less than that at the all India level.

Amulya Reddy (1991) explains an alternative scenario for Karnataka's electricity sector on the basis of the development focused end-use-oriented (DEFENDUS) paradigm. The recent efforts at electricity planning in Karnataka, in 1987 report of the Committee for preparing a ‘Long Range Plan for Power Projects’ in Karnataka 1987-2000 AD' (LRPPP), are clear-cut examples of the failure of the conventional consumption obsessed supply biased approach to energy planning. The DEFENDUS scenario for energy demand and supply focuses on people based development through the promotion of energy services, identifying technological opportunities for better utilisation of energy through a scrutiny of the end-uses of energy and adhering to a least cost approach to the mix of energy supplies. Even though the DEFENDUS scenario involves the illumination of all homes in Karnataka, an emphasis on employment generating industry, the energisation of all irrigation pump sets up to the limit imposed by the groundwater potential and the establishment of decentralised rural energy centres in villages, it comes out with energy and power requirements in the year 2000 which are only about 38 per cent and 42 per cent respectively, of the Long Range

Plan for Power Projects (LRPPP) demand. Gupta et.al. (1996) made a study on Electricity pricing in India by selecting three SEBs namely: Gujarat State Electricity Board, Maharashtra State Electricity Board and Rajasthan State Electricity Board .They worked on cost of electricity generation, Interest & finance Charge, average cost of power supply and tariff structure. They criticised that the low tariff was applicable even to the rich farmers. It was suggested that rich farmers should be charged on the basis of marginal cost of supply. Small farmers amy be provided subsidy if required. However, the amount of subsidy to be paid by the government should be equivalent to the difference between the marginal cost based tariff and actual revenue realised from the agricultural consumers.

Parikh, Painuly and Bhattacharya (1996) analysed the performance of various SEBs. It concluded that there was an urgent need to take appropriate steps to improve the operational as well as financial performance of the SEBs. By taking various measures for performance improvement, the SEBs can not only sustain their daily operations, they can also generate surplus revenue internally to finance the capacity addition programmes. Amulya and Sumithra (1997) conducted a study on Karnatakas power sector. In the study, they made an attempt to estimate the power consumption of irrigation pump-sets. The main objective of this study was to develop a methodology for making a reliable estimate of the transmission & distribution losses. It was observed that most of the agricultural consumption is un-metered, so the reliability of estimates of energy losses depends on the accuracy ensured in measuring the power consumption made by agriculture sector. The study concluded that major component of the T&D is the pilferage of power. The study has also pointed out that overstaffing was one of the major problems in the development of power sector in Karnataka. analyzed Karnataka power sector's present situation and looked at the trend of electricity demand and supply, Karnataka Electricity Board's financial problems, the important policy and technical milestones in the development of Karnataka power sector and the winners and losers from the pattern of development of power sector and also chart the way forward. They expressed the view that Karnataka power sector uses they

the irrigation pump sets package to hide many of its technical and commercial shortcomings, in particular its transmission and distribution losses. They also justified the invitation to private power with all associated benefits including in the case of foreign private power. According to the authors, what are required are not only realistic and small measures on the institutional demand and supply sides for the immediate and near term but also a vision of a sustainable future.

According to Douglas Wood Devendra Kodwani (1997) privatisation of public sector enterprises becomes an important policy issue in the context of the current liberalisation and deregulation of the industrial sectors in India, Already some initiatives on disinvestment in public sector enterprises have been taken by the Indian government. The key issues revolve around the 'degree of restructuring the state enterprises or industries to be privatised, the speed and timing of such restructuring and the methods used for transfer of ownership from public sector to private sector. The discussion focuses on privatisation of electricity supply industry, a key sector in economic development in India. Privatisation of British Electricity Supply Industry was preceded by radical changes in the industry structure and restructuring of the firms in the industry and was accompanied by a tight regulatory framework intended to promote efficiency and competition. Eberhard, Jochem (1997) in his work explained that as the long run potential for energy efficiency reduces useful energy demand and the proceeding levels of energy conservation. Future energy policy of most countries and on the international level will have to broaden substantially its scope from energy supply to energy services. The success of this new policy process will be worth the effort from the economic, social and environmental prospective.

The World Bank studies (1997) showed that since 1980 china’s energy intensity has fallen by 50 percent per year. This was mainly due to the gains in industry and slow residential energy growth, structural factors, i.e., shifts in final as well as intermediate demand for goods and services, driven by changing product mix. Technical change, that is shift in technologies, processes

management and government policies for producing goods and services have also been important in lowering energy intensity.

Devendra Kodwani (2000) argued that regulation of economic activities is often justified as a policy instrument to minimise the harmful impacts of market failure. But the role of a regulatory body should be defined clearly. The existing relationship between the regulator and regulated utilities needs to be rationalised. The role of regulator is to promote economic efficiency protecting the economic interest of electricity consumers. Jayasanker et al. (2000) in their study shows that KSEB's solvency and creditworthiness will be undermined to a critical point if its financial performance does not improve over the next couple of years. The restructuring of KSEB's financial viability has to be addressed at different levels through a series of practical measures in order to limit to the tariff increase to socially acceptable levels, while ensuring a sustainable solution to Kerala power sector. Some of the measures for developing a sensible financial reform package are discussed in detail in this paper. Das Anjana and Parikh Jyoti (2000) conducted a study to evaluate the financial performance of the Maharashtra State Electricity Board (MSEB). It examined the pricing policy followed by MSEB. It concluded that the pricing policy adopted by the Board was not appropriate. The tariff structure was highly skewed across various categories of consumers. Some consumer categories such as agriculture and domestic were charged at very low rates. Further, the subvention paid on part of the state government was not adequate to cover the cost of power supply to the agriculture sector. It was suggested the tariff should be based on the cost of power supply. The state government should pay adequate subsidy to the Board to compensate its revenue gap on account of power supply to agriculture sector.

Anjula and Rahul (2001) examined the past problems of power sector and initial phase of reforms. They said the Uttar Pradesh State Electricity Board's poor financial condition and growing power shortages necessitated the radical reforms in the state power sector. They said that the reforms model being implemented is based on incomplete diagnosis of the Board's past problems. High cost of power

purchase, arbitrary depreciation norms, misrepresentation of agricultural consumption and over reporting of impact of subsidy, were as important reasons as were poor maintenance, poor productivity, high transmission and distribution losses, poor billing efficiency and high subsidy to agriculture, in affecting the financial performance of the Board. They opined that besides lack of recognition of the former set of causes, the reforms process is ridden with other major pitfalls like shortage-prone gaps in the proposed model and ad hoc handling of its implementation. It appeared to them that the proposed reforms model appears to have been conceived out of desperation to escape from financial burden imposed by past mistakes, rather than out of a conscious reorientation of past policies, structures and systems in keeping with international changes in technological and competitive environment.

Dubash et al (2001) have analyzed the social and political context in which power sector reforms have taken place in India. The authors argued that the design of the restructuring process should aim promoting the economic efficiency on the one hand, and protecting larger public interest on the other. It is a matter of great public concern that most of the international donor agencies were not very sensitive to the local issues in power sector. It is further suggested that the electricity consumers especially the civil society actors should play a more active role in the process of reshaping the power sector industry in India. The authors argue that increased access to the electricity, social pricing and the promotion of sustainable energy policy should be the important issues in the overall process of power sector reforms in the country.

Kannan and Vijayamohanan Pillai (2001) have attempted to analyse the political economy of Indian power sector with special reference to Kerala in the light of a generic model of the political economy of public utilities. The model seeks to explain the political economy of the rent seeking drivers in a non-smithian imperfect regime of self- interest maximization, with a regulatory structure of the public utility described in a framework of the principal- agent relationship. They also attempt to estimate the costs of corruption involved in the administration of the power sector. Kannan and Vijayamohanan Pillai (2001) on

"Time and cost overruns of the power project in Kerala", analysed the cost of inefficiency involved in the time and cost overruns in the power projects of the KSEB and their possible causes. They found the arguments by the government in favour of private sector participation in power generating capacity addition, under the pretext of severe resources crunch, is flimsy to the extent that the government is actually over- spending on each of the projects undertaken. They found that the real problem arises out of the inefficiency of management coupled with the political economy of vicious rent seeking. India infrastructure Report (2001) of Oxford reveals that the financial performance of power utilities depends upon the pricing policy and management efficiency level achieved by respective utility. In the pre-reforms period, the financial and administrative decisions of the utilities were highly influenced by political pressures. It led the utilities into huge financial crisis. Consequently, the utilities were not able to manage the operational activities efficiently.

Kannan and Vijayamohanan Pillai (2002) in their study made an attempt to detailed diagnosis of the accumulated inefficiency in the Indian power sector, the consequent reform drivers and the political economy involved in these aspects by focusing on the Kerala power sector. They also made suggestions about capacity/ energy deficient and cost efficiency. The study also gives information about the improved performance of the power sector in the context of Kerala. Santhakumar (2003) in his paper studied the power sector reforms in Kerala between 1996-2000, which was aimed mainly at enhancing generation capacity and improving the efficiency of the state electricity board. It looks at the potential gainers and losers of the two component of the reform policy. The study provides a board indication of the kind of distribution of cost and benefits of non-reform that would be conductive to sustain reforms, especially with supports from the electorally influential middle class. Verma (2004) in his study on "Power reforms- Overview of power sector" explained that the major challenge of the power sector is continue with the reform, improve the financial health of the utilities, to enable competition and acceleration of economic growth, while protecting the

environment and most importantly to raise the comfort level of the common man by making available quality and affordable price

Severin Borenstein and Stephen Holland (2005) in their study explained that most customers in electricity markets do not prices that frequently to reflect changes in whole sale costs, known as Real Time Pricing (RTP). It shows that not only does time invariant pricing in competitive markets lead to prices and investment that are not first best, it even fails to achieve the constrained second best optimum. Seung (2006) the empirical study of the paper investigate the causal relationship between electricity consumption and economic growth among the Association of South East Asian Nations (ASEAN) 4 members, Indonesia, Malaysia, Singapore and Thailand using modern time-series techniques for the period 1971-2002. The results indicate that there is a bi-directional causality between electricity consumption and economic growth in Malaysia and Singapore. This means that an increase in electricity consumption directly affects economic growth and that economic growth also stimulates further electricity consumption in the two countries. However, uni-directional causality runs from economic growth to electricity consumption in Indonesia and Thailand without any feedback effect. Thus, electricity conservation policies can be initiated without deteriorating economic side effects in the two countries.

Pani, B. Saranga (2007) on the Power Sector Reforms in Andhra Pradesh to assess the impacts of electricity sector reform. In the study, an attempt was made to evaluate the operational performance of generation as well distribution segments as a result of power sector reforms process initiated in the state. The proposals of Annual Revenue Requirement (ARR) and the Tariff Orders (against various ARRs) issued by Andhra Pradesh Electricity Regulatory Commission (APERC) were used main data sources for the study. It was concluded that the reforms had led to a neglect of capacity addition programmes in the state sector. At the same time, the share of private sector in total generation capacity increased. Per unit cost of power purchase from the private producers was higher. Consequently, the average cost of power purchase showed an increasing trend.

The study further pointed out that in spite of huge investment made in the distribution sector, the energy losses level was reported to be at the higher side. However, there were substantial improvements in the revenue collection efficiency of the distribution companies. According to Cajsa Bartusch, Monica Odlare, Fredrik Wallin, Lars Wester (2011) improved means of controlling electricity consumption plays an important part in boosting energy efficiency in the Swedish power market. Developing policy instruments to that end requires more in-depth statistics on electricity use in the residential sector, among other things. The aim of the study has accordingly been to assess the extent of variance in annual electricity consumption in single-family homes as well as to estimate the impact of household features and building properties in this respect using independent samples t-tests and one-way as well as univariate independent samples analyses of variance. Statistically significant variances associated with geographic area, heating system, number of family members, family composition, year of construction, electric water heater and electric underfloor heating had been established. The overall result of the analyses is nevertheless that variance in residential electricity consumption cannot be fully explained by independent variables related to household and building characteristics alone. As for the methodological approach, the results further suggest that methods for statistical analysis of variance are of considerable value in indentifying key indicators for policy update and development.

After reviewing a number of books, journals and periodicals, it has been noticed that a systematic study based on secondary data and primary data is not available for Kerala State Electricity Board. Hence the present study is undertaken primarily to bridge this gap between data availability and academic writing. Thus, it is expected that this thesis will add to the exciting literature on electric power sector in Kerala especially with regard to energy conservation practices and consumption behaviour.

1.3 Research Problem

Kerala is a state whose primary energy source is electricity generated from its hydroelectric projects. Till mid 1980's Kerala was a state with excess supply of electricity which was sold to its neighbouring states. But from 1985 onwards the trend started reversing mainly due to the unprecedented increase of household users basically due to the massive home electrification campaigns by the state government. Currently the state faces acute shortage of electricity in summer especially in the years of monsoon failures. Adding fuel to the fire, misuse of electricity by the consumers, lack of awareness of the people regarding the need to save electricity, increased usage of modern electric gadgets and home appliances made the crisis much worse. Many times the Government and Kerala State Electricity Board (KSEB) which is the monopoly electricity supplier in the state are forced to increase the tariff rates, impose power cuts and load shedding.

According to the latest status of states survey conducted by India Today in 2013, Kerala state has the first position in the developmental activities among the Indian states. In the case of electricity needs, the state depend on other states; i.e., produce less than half of the electricity needed and depend mostly upon the hydro electric power (almost 65%) within the state. Kerala State Electricity Board (KSEB) is the main channel to allocate the electricity needs in the state. The increase in demand will increase the average cost of supply, because of the declining share of hydropower and the need to buy costlier thermal power from other states. This can put further pressure on the financial position of the KSE Board, or it will be forced to reduce the quality/quantity by not buying adequate power from the national grid. KSEB bear heavy burden, while importing electricity from other states. In this context it is useful to assess the financial position of Kerala State Electricity Board (KSEB) with particular emphasis on the cost and tariffs during 2004-05 to 2014-15.

Kerala is a consumer state different from other neighbouring states like Tamil Nadu and Karnataka. In Kerala consumption of electricity is mainly for

domestic purpose (49%). There are several external factors influencing this consumption pattern. The main factors are education, income, foreign remittances, migration, advertisement of electric gadgets etc. These variables are leading to large electricity consumption. In Kerala consumerism led to the purchase of modern electric or electronic gadgets even among lower middle class people which in turn increased the electricity consumption of the households. In this context, consumption behaviour is important in determining the quantity of electricity consumption of the household. Proper conservation practices are to be adopted to overcome the near future power crisis in our state. There are numerous ways for conserving electricity which include careful use of electric gadgets, using gadgets of higher efficiency, depending alternative sources of electric energy etc. It is useful to know whether the households are aware and adopting these practices and also to know whether there is any difference in the electricity consumption behaviour among KSEB & TCED consumers. An attempt has been made in this study to check people's conservation practices and their knowledge about electricity saving methods.

1.4 Objectives of the study

So the study is made with the following specific objectives.

1. To analyse the financial and physical performance of Kerala State Electricity Board during 2004-05 to 2014-15.
2. To assess the pricing methods adopted by Kerala State Electricity Board.
3. To examine the Household electricity consumption behaviour in Thrissur Corporation
4. To compare the electric energy conservation practices among households under KSEB & TCED.

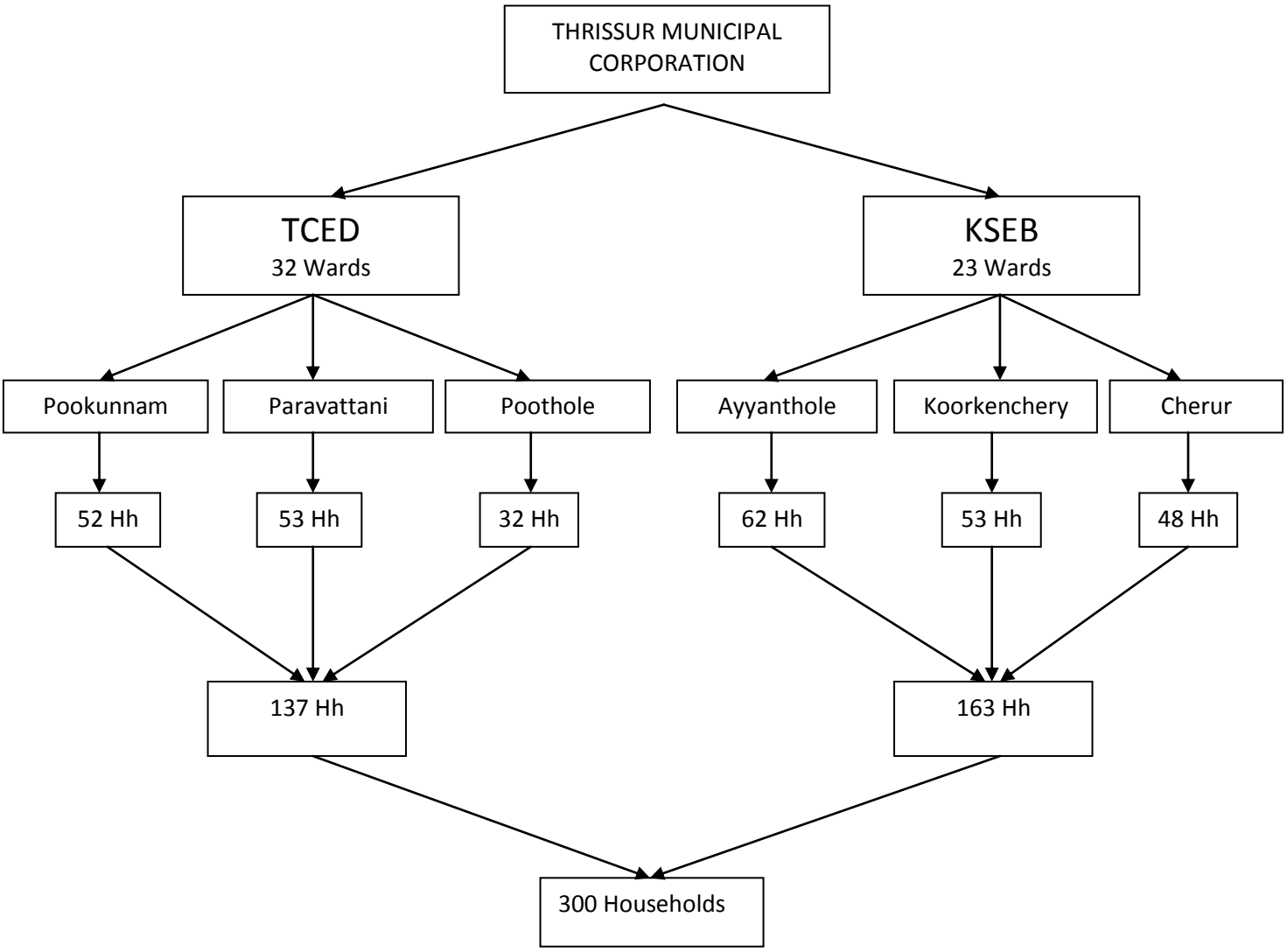
1.5 Data Source and Methodology

The present study is based on secondary and primary data. The main sources of secondary data are the annual publications of the Kerala State Electricity Board (Annual Report, Annual accounts and Power system statistics) Publications of the Directorate of Economics and Statistics, State Planning Board, Publications of the Central Electricity Authority etc.

Both descriptive and analytical methods are adopted for the study. The financial performance of the Board during the period between 2004-05 and 2014-15 is analyzed using time series data drawn from the various financial statements provided in the annual accounts. Estimates of annual trend and financial ratios have been used for this purpose. The cost of production and supply of electricity at different categories of consumers are analyzed in detail using simple arithmetic methods. Detailed methodology will be given at the beginning of each chapter.

Primary data were collected from household electricity consumers in Thrissur corporation area during the months of February, March and April 2016. Thrissur Corporation is one of the 9 licensees of procuring energy from KSEB at bulk tariff and supply energy to the consumers. Also Thrissur Corporation is the only local government authority in Kerala which undertakes this task of electricity supply. It is noticed that Thrissur Corporation electricity department (TCED) is the electricity provider to the consumers in 32 wards in Thrissur Corporation, which were the area under old Thrissur Municipality. The remaining 23 wards in Thrissur Corporation are under KSEB where KSEB is the authority for electricity supply. For the purpose of the study we selected 300 households from Thrissur Corporation. The sampling framework is given in organogram 1.1

Organogram 1.1



There are 55 wards in Thrissur Corporation out of which 32 wards are under TCED and 23 wards are under KSEB for electricity supply. From 32 wards under TCED, 3 wards were selected on the basis of higher number of household consumers and 5 percentage of consumers from each of these 3 wards where randomly selected as sample. Thus 52 households from pookunnam, 53 households from paravattani and 32 households from pothole constituted 137

households of households consumers and 5 percentage households were selected from each of these wards, Ayyanthole (62), Koorkenchery (53) and Cherur (48) households which constituted 163 households. Thus our sample size is 300 households.

Electricity consumption behaviour of the households is analysed with respect to the socio-economic variables like religion, social groups, type of family, economic status, education, income etc... Chi square test is used to study whether there is any association between electricity consumption and the socio- economic variables. Also a multiple regression analysis has been done using the model $\mathbf{Y_i = \alpha + \beta_1 X1_i + \beta_2 X_{2i} + \beta_3 X_{3i} + \beta_4 X_{4i} + U_i}$ Where Yi = Consumption expenditure of electricity, X_1 = Family size, X_2 = education status of family head, X_3= Purpose of electricity usage, X_4= family income.

To study the dependence of electricity consumption expenditure on total consumption expenditure on a simple regression model was fitted. $\mathbf{Y_i = \alpha + \beta_i X_i}$ $+U_i$ where Y_i = electricity consumption expenditure of i^{th} household and X_i = Total consumption expenditure of i^{th} household

Awareness and Practice of households regarding electricity conservation are measured using 5 point liquored scale measure. In this context a comparative study of TCED and KSEB consumers was made using t test. Also the dependence of practice on awareness is analysed using simple regression function, $Y_i = \alpha + \beta_i X_i + U_i$, where Y_i = Practice level of i^{th} consumer and X_i is the awareness level of i^{th} consumer.

1.6 Scheme of the Study

The study is presented in five chapters. The introductory chapter initiates the topic; explains the overview, review of literature, research problem, objectives of the study, data source and methodology and sample design of the study. Physical and financial performance of KSEB is analysed in chapter two. It also explains trend analysis for physical performance and ratio analysis for financial performance of KSEB. Third chapter explains the electricity pricing method used by KSEB. Household electricity consumption behaviour of Kerala is explained in fourth chapter and it also explains electricity conservation practices of households. Last chapter gives the summary of findings and conclusion.

2.1 Introduction

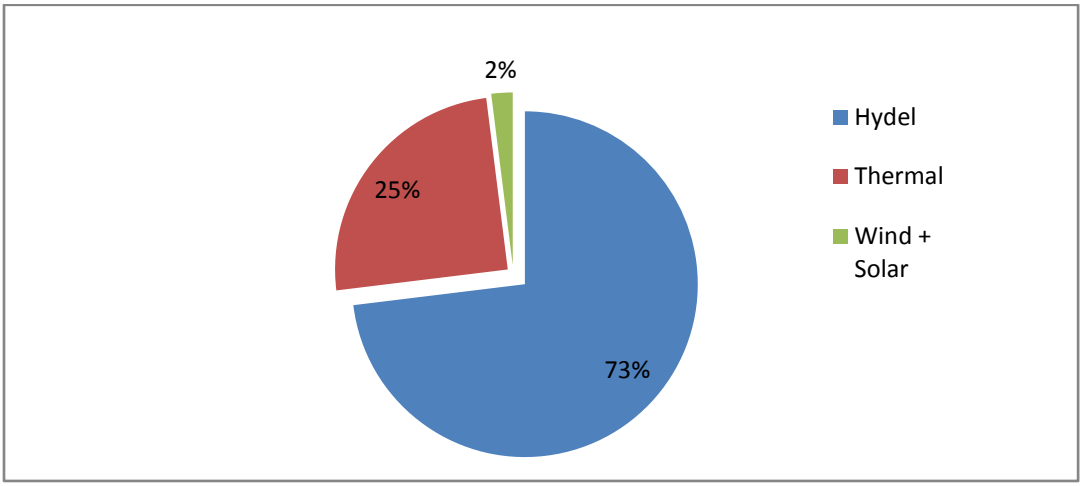
The Kerala State Electricity Board Ltd (KSEBL) was constituted as an independent regulatory body to regulate the generation, transmission and distribution businesses in the power sector. The Electricity Act, 2003 was enacted to replace the Electricity Supply Act 1948 with a primary goal to improve the efficiency and quality of power sector services. The Electricity Act 2014 was given more importance to tariff restructuring and improving distribution system through the establishment of 400 kV line. KSEB has been responsible for generation, transmission and supply of electricity in the state, with particular emphasis to provide electricity at affordable cost to the household consumers' as well as to Industrial and Agricultural sector. The board has been taking several initiatives to improve its physical and financial performances during the past ten years.

In this chapter is an attempt is made to examine the physical and financial performance of KSEB during the period from 2004-05 to 2014-15. The physical performance is evaluated by assessing the demand and supply of electricity in the state. The variables under study are generation, transmission and distribution of electricity. The generation of electricity in the state is examined on the basis of sources like hydel, thermal and wind. The improvement in Transmission & Distribution is evaluated on the basis of length of lines. The efficiency of transmission and distribution is analysed by examining the trend in transmission and distribution loss. The financial performance of KSEB is studied using ratio analysis. The short term financial ratios like current ratio, quick ratio, cash ratio, working capital ratio etc.., and long term financial ratios like fixed asset turnover ratio, current turnover ratio etc.., are used for evaluating the financial performance of KSEB.

2.1.1 Energy Requirement and Availability

Total installed capacity of power in 2016 is 2920.20 MW of which, hydel contributed the major share of 2104.3 MW (73.06 per cent); while 718.46 MW (25 percent) was contributed by thermal projects, 43.27 MW (2 percent) from wind and 14.15 MW from Solar. Figure 2.1 highlights the total installed capacity of Kerala from hydel, thermal and other renewable sources.

Figure 2.1
Total Installed Capacity



Source: Kerala State Electricity Board (2016)

Kerala State Electricity Board 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 in the recent years. 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 reconfirmed the validity of its current data and therefore, the same has been considered for the study purpose.

Table 2.1
Installed Capacity in Kerala from different Energy Sources (MW)

Sources of energy	2008-09	09-10	10-11	11-12	12-13	13-14	14-15	15-16
Hydel KSEB	1888.1	1893	1998	2008.8	2010	2013.7	2031	2046
Hydel: Captive	33	33	33	33	33	33	33	33
Hydel: IPP	0	7	10	10	10	10	11	11
Thermal	234.6	234.6	234.6	234.6	234.6	234.6	234.6	234.6
Thermal; IPP	179	189	189	199	199	199	199	199
NTPC	359.6	359.6	359.6	359.6	359.6	359.6	359.6	359.6
Wind	2.03	2.03	2.03	2.03	2.03	2.03	2.03	2.03
Wind IPP	21.9	28	31.6	32.8	32.8	33.4	34.5	35
Total	2718.2	2746.2	2858	2879.8	2881	2885.3	2905	2920

Source: Compiled from Annual Report of KSEB for various years.

Table 2.1 gives the total installed capacity of power in the state during 2015-16 was 2920.30 MW of which the contribution of Hydel, Thermal and Wind sources were 2046.15 MW,159.96 MW and 2.025 MW respectively. The contribution of State public sector is 2209.2 MW (76.7 per cent), Central sector 359.6 MW (12.4 per cent) and Private sector is 311.31 MW (10.8 per cent) during 2015-16 it shown in table 2.2. The Kerala's power situation is largely dependent on Monsoon owing to sizeable Hydel capacity which explains the variations in demand supply scenario.

Table 2.2
Sector wise contribution of installed capacity

Central Sector	359.6 (12.4)
State Sector	2209.2 (76.8)
Private Sector	311.31 (10.8)

Source: Kerala State Electricity Board (2016)

The energy requirement including all categories of consumers as well as energy availability in the state have grown at almost same Compound Annual Growth Rate (CAGR) of 4.9 percent and 5.2 percent respectively based on data from year Financial Year 2009-10 to Financial Year 2014-15 furnished by the state. The details of power availability during the last five years are shown in Table: 2.3

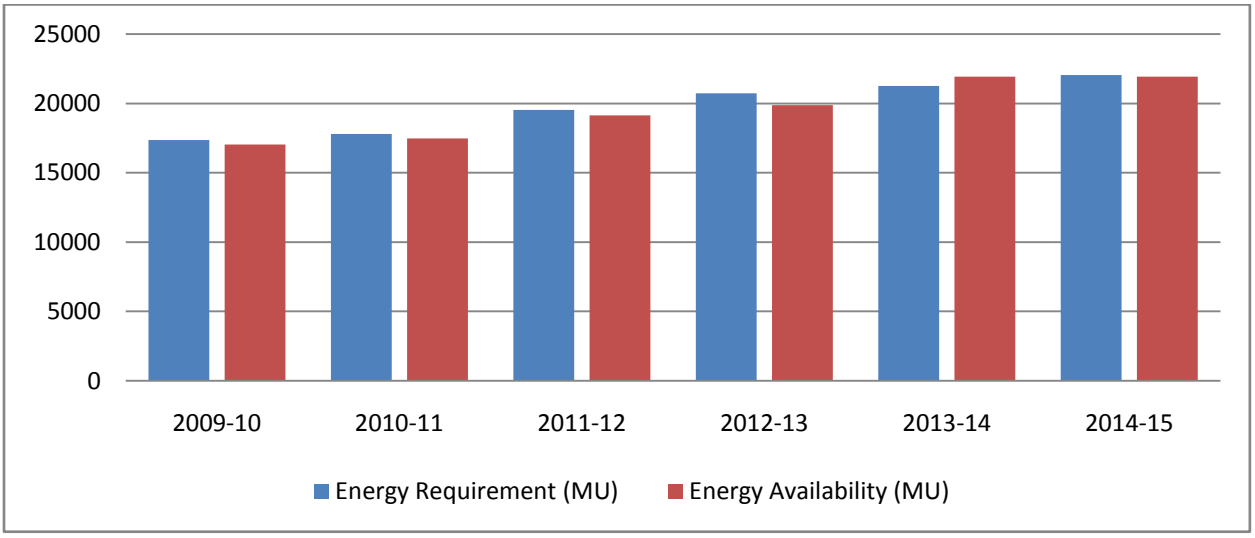
Table: 2.3
Details of Power Availability

	2011-12	2012-13	2013-14	2014-15	2015-16
Hydel Generation	8058.01	4848.76	7995.43	7134.00	6639.02
KSEBL - Thermal Generation	290.7	532.7	220.87	207.7	150.63
Wind	2.03	1.763	1.8	1.06	1.38
Solar	0	0	0	0	0.81
Solar other than KSEBL	0	0	0	0	5.92
Total Internal Generation	8350.75	5389.62	8218.10	7342.88	6791.85
Less : Auxiliary Consumption	60.84	55.35	55.07	55.97	52.60
Net Generation	8289.91	5334.27	8163.03	7286.91	6739.25
Power Purchase (CGSs, IPPs, Traders)	11263.21	14908.82	14070.42	14996.43	16448.36
External PGCIL line	413.21	364.96	293.69	357.98	550.60

losses					
Energy Available for sale within the State	19139.9	19878.13	21939.76	21925.81	22944.45
Energy Requirement	18938.81	19877.16	20525.16	21914.17	22583.53
Surplus/Deficit	201.09	0.97	1414.60	11.64	360.92

Source: Compiled from Annual Report of KSEB for various years

Figure 2.2
Energy Requirement and Availability



Source: *compiled from Annual Report of KSEB for various years*

2.1.2 Category Wise Consumer

At the end of year 2015 there are about 111.92 Lakhs of electricity consumers in the state, out of which about 4.63 Lakhs consumers are under agriculture category. The category wise number of consumers at the end of 2015 is shown in Table-2.4

Table 2.4

Category Wise electricity Consumers

Category of Consumers	Number	Connected Load (MW)	Consumption in (MU)
Domestic	8788916 (78.52)	12428.24 (63.14)	8739.52 (50.07)
LT Commercial	1795160 (16.04)	2905.34 (14.76)	2229.34 (12.77)
LT Industrial	137744 (1.23)	1620.52 (8.23)	1096.56 (6.28)
HT & EHT Industrial	4256 (0.04)	1316.68 (6.69)	4035.49 (23.12)
Public Lighting	3789 (0.03)	110.99 (0.56)	319.06 (1.83)
Agricultural	463006 (4.14)	952.77 (4.84)	310.24 (1.78)
Railway traction	8 (0.004)	66.25 (0.34)	200.69 (1.15)
Miscellaneous	11 (0.006)	204.23 (1.04)	523.15 (3)
Total no of consumers	11192890	19684.15	17454.05

Source: State power utility 2016

Table 2.4 shows the category wise electricity consumers in Kerala. The largest portion of consumers are in domestic category (78.52 percent) followed by LT commercial consumer's (16.04percent). The household consumers consume 50 percent of the total consumption (8739.52 MU). 0.04 percentage of consumers (HT & EHT Industrial) consume about 23.12 percentage of the total consumption. Agricultural consumers about 1.78 percent total industrial (LT, HT & EHT) consume about 29.4 percent.

2.2 PHYSICAL PERFORMANCE

We analyse the Physical Performance of Kerala State Electricity Board in terms of generation, transmission and distribution.

Table: 2.5

Physical Performance during 2004-05 to 2014-15

Years / Particulars	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	**CAGR**
(a) GENERATION												
Capacity additions (MW)	3.0	14.0	13.0	5.0	34.5	22.4	11.6	15.2	17.3	18	19.8	**0.12**
(b) TRANSMISSION												
EHT substation (no.)	26	19	15	16	18	25	10	12	15	18	19	**-0.03**
EHT lines (circuit km)	206	256	107	108	176	266	136	87.9	108	112	119	**-0.06**
(c) DISTRIBUTION												
No. of consumers (lakh)	5.48	5.48	4.79	4.82	4.45	4.48	4.42	4.13	4.10	4.17	4.23	**-0.03**
LT lines (circuit km)	4725	6439	8229	8128	7636	7838	6928	4089	5028	5981	6422	**-0.02**
HT lines (circuit km)	675	1062	1819	1807	3018	3398	3645	3897	4276	4862	5234	**0.21**
No. of distribution transformers	1894	1778	2148	2553	4109	5790	5800	4375	4810	5302	5915	**0.13**

Source: Compiled from Annual Administration Report of KSEB for various years

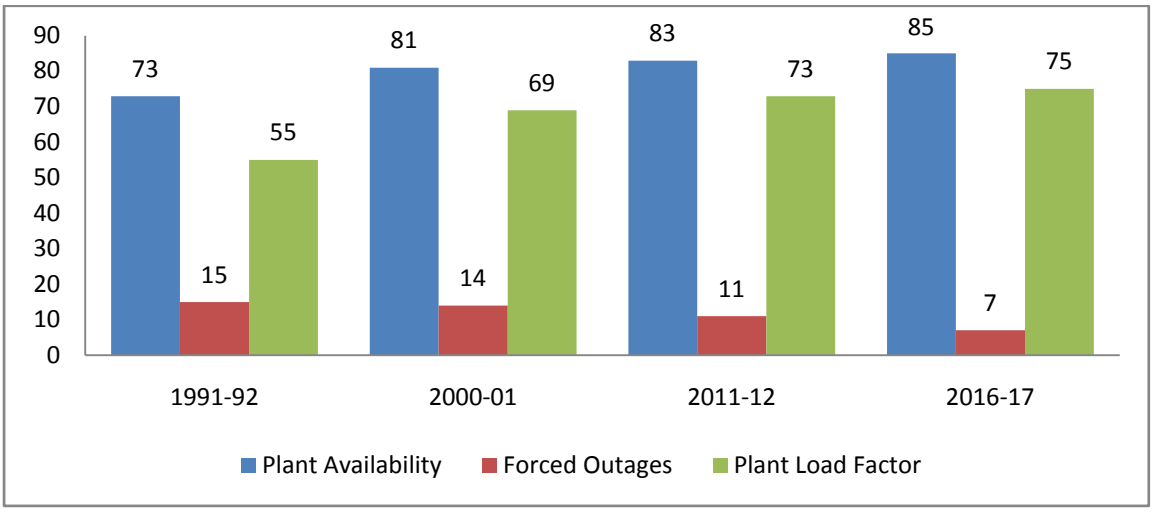
Table 2.5 shows the generation, transmission and distribution of KSEB physical performance from 2004-05 to 2014-15. The Compound Annual Growth Rate (CAGR) shows during this period the electricity generation has been increased by 0.12 percent on average per annum while the growth in HT lines was 0.21 percent. Also the number of distribution transformers has been increased on average by 0.13 percent per annum.

In this section, the technical performance is measured on the basis of some key parameters such as Plant Load Factor (PLF), Transmission and Distribution Losses (T&D losses), collection efficiency, Aggregate Technical and Commercial Loss reduction (AT& C loss reduction) and electricity generation performance.

2.2.1 Plant Load Factor

Plant Load Factor (PLF) is the ratio between the actual energy generated by the plant to the maximum possible energy that can be generated with the plant working at its rated power and for duration of an entire year. A plant load factor is a measure of average capacity utilization. For about a decade during 1991-92 to 2000-2001, the Plant availability factor (PAF) has been increased from 73 percent to 81 percent. During this time, the average PLF also increased from about 55 percent to about 69 percent. Since then, there has been improvement in both, plant availability and PLF. At the end of 2011-12, the plant availability increased to about 83 percent on All India basis whereas the PLF increased to the level of 73 percent. Similar improvement has also been seen in respect of forced outages of thermal stations, whereas in the year 1991-92, it was about 15 percent and it has come down to about 11 percent by the end of the year 2011-12.

Figure: 2.3
Plant Availability, PLF and Forced Outages (in %)



Source: Compiled from Annual Report of KSEB for various years

Figure 2.3 shows the comparison between plant availability, forced outage and Plant Load Factor (PLF). The PLF and PAF (Plant Availability Factor) are increasing in these periods and the same time forced outage decreasing trend.

2.2.2 Capital Account

The Company has approved an amount of 1500 Crore towards capital investment during the year 2017-18 as a part of Annual Plan 2017-18. Since the year 2008-09, the Board has been following the decentralized planning process for finalizing the capital investments in Generation, Transmission and Distribution (KSEBL)

The target of KSEBL will be to enhance energy generation through various hydel, wind and solar projects and to meet demand through energy conservation methods. The Independent Power Producer (IPP) concept will be encouraged to provide more resources for development of capacity, and also from energy conservation measures. “Energy saved is equivalent to energy produced” concept will be aggressively pursued. It is targeted to reduce the T&D losses to a level of 13.85 percent by the end 2017-18 largely through timely implementation of various schemes. Managerial efficiency and productivity will be sought to be enhanced with the help of management institutions. KSEBL has set a target for providing quality

power at affordable rates to all needy consumers. To meet this ambitious target, KSEBL has to either develop new generation capacities or purchase additional power from other sources or otherwise opt for balance blend of both. The transmission net work and distribution network should also be strengthened to meet the increase in consumer needs. The revised Capital outlay fixed for the year 2016-17 is 1345.00 Crore and the proposed outlay for 2017-18 is 1500.00 Crore for performing Generation, Transmission and Distribution scheme works.

Kerala is one among the very few states in the country where there was no load shedding and power cut during 2008-09. KSEB has been responsible for the generation, transmission and supply of electricity in the State of Kerala, with particular emphasis to provide electricity at affordable cost to the rural population and for agricultural purposes. The Board has been passing through a transitional phase of reforms in the electricity sector. The Electricity Act 2003 envisages separate organizations for Transmission and Distribution etc. (Economic Review 2009)

2.2.2.1 Generation

Increasing the capacity of hydel generation by harnessing the untapped potential in the State without much disturbance to the forest and its biodiversities is the key strategy followed by the Company. Hydel energy being green energy and low cost one, Company continues to concentrate on adding to the capacity of hydel generation. The capital outlay for generation work for the year 2016-17 is 291.50 Crore and for 2017-18 is 371 Crore.

As per the seventeenth power survey, there is an additional generation requirement of about 1000 MW for the state during next five years. KSEB has set a target for providing affordable and reliable electricity to all households on demand by 2017. Water is the only commercially viable source for power generation within the State. To ensure reliability of supply as well as energy security, capacity addition in Kerala has to be given due importance. Meanwhile, KSEB has proposed to add about 610.50 MW of new hydel capacity during eleventh plan period. (Economic Review various years)

The electricity demand of the State is met through generation from KSEBL, Central Generating Stations (CGS), Independent Power Producers (IPPs) and Traders. Generation from KSEBL's own plants provide 30 per cent (6791.8 MU) of the total energy requirement. Import from CGS, IPPs, UI and Traders provides the rest of the (15791.6 MU) total requirement 19378.55 MU of energy was sold (including sales outside the State) during the year 2015-16. The total additional capacity added from all sources during the year 2015-16 was 44.5 MW.

2.2.2.2 Transmission and Distribution

Transmission of Electricity is defined as bulk transfer of power over a long distance at high voltage, generally more than 132 KV. It is an important sector to evacuate the power in different parts of Kerala. A good transmission facility is necessary to effective distribution and to bring power from outside the state. In the transmission Sector commissioning 66 Numbers of substations and construction of 587.19 kms of transmission lines has been targeted during the period under review. Out of which 5 substations and 116.5 kms of lines were commissioned as in 2009. Now there are two 400 KV substations. One at Madakkathala (Thrissur) and the other at Pallippuram (Thiruvananthapuram). Also another 400 KV substation at Arecode (Malappuram District) is being constructed by Power Grid Corporation of India Ltd. (PGCIL). The site for the construction of this substation has been identified and taken over by PGCIL and the route Survey for the construction of Mysore - Arecode line has also been completed. Thus, there will be one 400 KV substations in each region of Kerala, i.e. North, Central and South.

A good transmission system is necessary for effective distribution and to procure power from outside the State. In the Transmission sector, many planned works could not be taken up due to land acquisition and right of way related issues. In the year 2015-16 out of the target of 12 numbers of 110 kV substations, 8 substations were completed and in the case of 66 kV substations, 3 substations were completed against the target of 4. In the case of 33kV substation, 3 substations were completed while there is no progress in the case of 220kV sub stations. Kerala's

transmission system consisting of substations and its connected lines are given in table 2.6

Table: 2.6

Transmission and Distribution Lines

Year	Length of Lines (km)						
	220 kV	110 kV	66 kV	33 kV	22 kV	11 kV	LT
2003-04	2656.7	3822.8	2067.0	514.2	156.6	32578	204385
2004-05	2668.9	3894.7	2072.1	686.0	156.6	33534	210458
2005-06	2715.4	3966.0	2120.5	778.7	156.6	34596	217899
2006-07	2715.4	3993.7	2150.8	909.8	156.6	36419	226128
2007-08	2716.4	4050.1	2161.9	1015.2	156.6	38235	234286
2008-09	2716.4	4067.6	2161.9	1184.8	156.6	41283	241849
2009-10	2734.7	4115.9	2161.9	1390.2	156.6	44682	249687
2010-11	2734.7	4150.1	2161.9	1453.8	160.6	48342	256449
2011-12	2734.7	4151.0	2161.9	1534.8	160.6	51328	260554
2012-13	2761.6	4178.6	2166.5	1599.7	160.6	52907	263620
2013-14	2775.4	4220.5	2185.4	1649.5	161.5	53409	272823
2014-15	2781.5	4295.9	2200.5	1760.4	163.0	53980	286383
2015-16	2801.9	4345.5	2220.6	1826.7	164.2	54895	295432

Source: Power system statistics (various years)

The distribution system of the power sector constitutes the final link between the power sector and the consumer. The efficiency of the power sector is judged by the consumers on the basis of performance of this segment. It constitutes the weakest part of the sector, which is incurring large losses. In view of the above, the real challenge of reforms in the power sector lies in efficient management of the distribution system. KSEBL distributes electricity in the state of Kerala except in the Thrissur Municipal Corporation and Munnar (KannanDevan Hills). For operational conveniences the distribution wing is divided into three zones namely South, Central

and North (Ksebea.in). The South zone with headquarters at Thiruvanthapuram has 6 Electrical Circles, 19 Division, 58 Subdivisions, 177 Electrical sections and a Regional Store Division at Kundara. The Central zone has 7 Electrical Circles, 25 Division, 75 Subdivisions, 230 Electrical section and a Regional Store Division at Aluva and its headquarters is at Ernakulum. The North zone with headquarters at Kozhikode 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, KannanDevan Hills Plantations Company (P) Ltd, Technopark, Thrissur Corporation Electricity Department, 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 2014-15.

In the distribution segment, there are 54895 Kms of 11 kV lines, 295432 Kms of LT lines 73460 nos. of distribution transformers. During the financial year 2015-16, 3, 81,247 service connections were given (against the target of 4,59 ,020), 2,022 kms of 11 kV lines (against the target of 2377kms) and 3312 kms of LT line (against the target of 4826 kms) were commissioned. The target and achievement of the distribution infrastructure during 2015-16 is given in table 2.7

Table: 2.7
Distributions System

Item	Target	Unit	Achievement	Unit	Percentage of achievement
11kV lines	2377	Km	2022	km	85.07%
Distribution Transformer	3574	Numbers.	2389	Numbers.	66.84%
LT lines	4826	Km	3312	km	68.63%
Service connections	459020	Numbers.	381247	Numbers.	83.06%

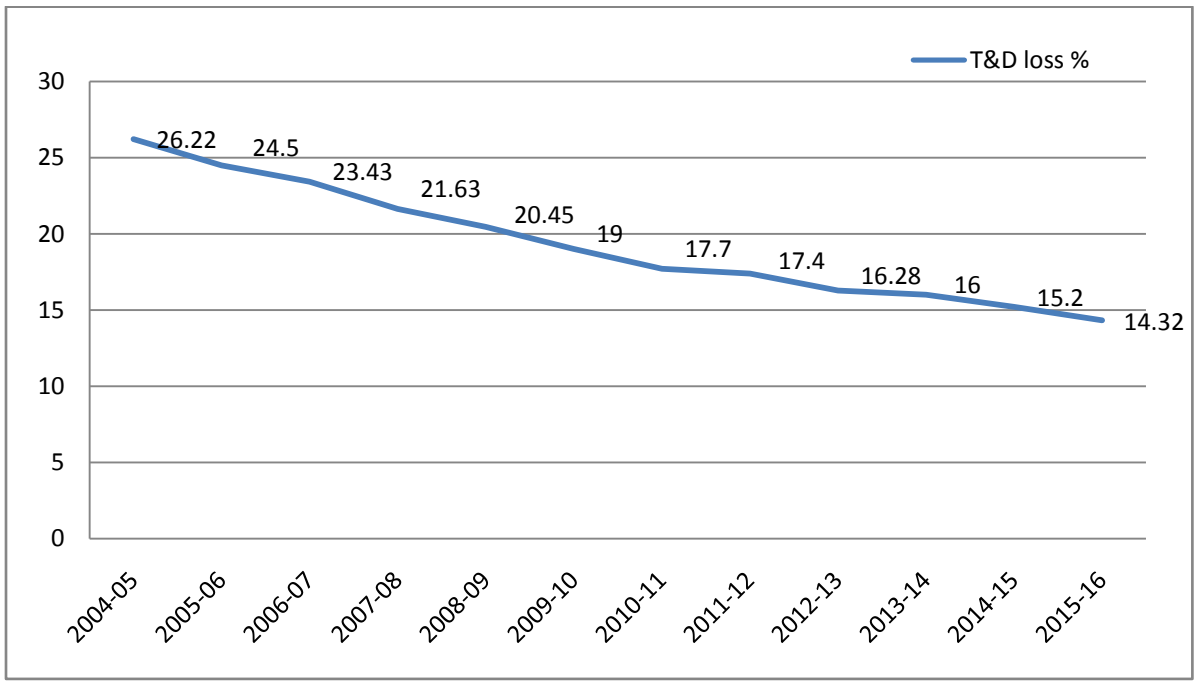
Source: Kerala State Electricity Board 2015-16

2.2.3 Transmission and distribution losses in the state

The high transmission and distribution losses were identified as one of the main reasons responsible for poor performance of the State Electricity Boards (SEBs) in India. Energy losses basically consist of technical losses and non-technical losses. Some technical losses occur due to inherent characteristics of the generation, transmission and distribution systems. In the process of transmission, transformation and distribution activities, some amount of energy is consumed by the conductors used as part of network system. Many times, energy is wastefully consumed due to defectiveness of equipments such as loose conducting and wiring. Energy is also consumed in the process of transformation from one voltage level to another, which is also a part of technical losses.

Figure 2.4

Transmission and distribution losses

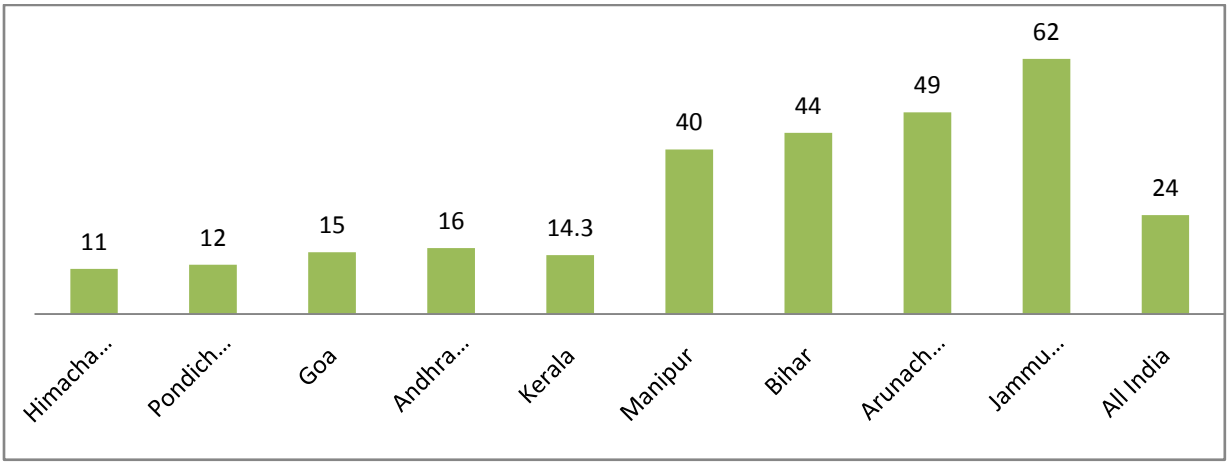


Source: Economic Review (various years)

Figure 2.4 explain the line graph of the Transmission and Distribution losses it decreased from 26.22percent in 2004-05 to 14.32 percent in 2015-16. During this period T & D loss decreased at 12 percentage. The trend line shows that in future the T & D losses will be decreased because of increasing number of Transmission lines

and distribution transformers. Figure 2.5 shows T & D losses across selected states during 2015-16. The T & D losses in selected states in India in 2015-16 is given in figure 2.5

Figure 2.5
T&D Losses across Selected States and in 2015-16 *(in %)*



Source: Economic Review 2016-17

During 2015-16, T&D loss has come down to 14.32 percent from 21.63 percent in 2007-08. KSEB made significant achievement in the field of reducing the T&D loss. During 2003-04 onwards T&D loss was considerably reduced by way of faulty meter replacement, intensification of theft detection, installation of new substations and lines, up gradation and modernization of sub transmission and distribution network through APDRP Scheme. This is in line with the efforts of reducing the loss by 2 percent every year.

The Transmission system needs to be strengthened in tune with the capacity addition and additional power purchase from CGS. KSEBL is giving due importance for enhancing the total load handling capacity of the Transmission system, avoiding bottlenecks/congestion in power flow, providing adequate redundancy in Transmission system to meet the system exigencies and ensuring availability of power in the state. The capital outlay of transmission works for the year 2016-17 is 310 Crore and 360 Crore for 2017-18 including System Operation works. The proposal for the year 2016-17 and 2017- 18 includes the construction of transmission lines and substations.

The Distribution system also needs to be strengthened in tune with the capacity addition in generation and strengthening of transmission network. With a view to improve consumer satisfaction, KSEBL is giving due importance for strengthening the Distribution network to provide uninterrupted quality power to the consumers, reduce the technical and commercial losses and to improve the quality of services rendered to the consumers.

Non-technical losses are termed as commercial losses. The commercial losses result from unaccounted and unpaid use of energy. This may be the result of inaccurate metering and poor billing methods. Another major component of commercial losses is the pilferage of power that is made by unauthorised users.

KSEB has been consistently reducing Transmission and Distribution losses in the Kerala power system. KSEB has been able to reduce T&D losses by half from 30.76 percent in FY 2001-02 to 14.32 percent in FY 2015-16. This in turn has resulted in substantial savings as the quantum of power purchased has reduced to the extent of T&D losses reduction achieved. The estimates of T&D losses are given in the table 2.8

Table: 2.8
Impact of T&D Loss Reduction

Year	Energy sold (MU)	Total energy input to KSEB system (MU)	T & D Loss (%)	Extent of reduction		Impact of loss reduction	
				years	cumulative	Saving (MU)	Income (in Crore)
2003-04	8910.80	12280.87	27.44				
2004-05	9384.40	12504.79	24.95	2.49	2.49	311.37	108.98
2005-06	10269.80	13331.09	22.96	1.99	4.48	597.23	209.03
2006-07	11331.00	14427.97	21.47	1.49	5.97	861.35	301.47
2007-08	12049.90	15065.15	20.02	1.45	7.42	1117.83	391.24
2008-09	12414.32	15293.51	18.83	1.19	8.61	1316.77	460.87

2009-10	13971.09	16978.03	17.71	1.12	9.73	1651.96	578.19
2010-11	14547.90	17337.78	16.09	1.62	11.35	1967.84	688.74
2011-12	15980.53	18946.29	15.65	0.44	11.79	2233.77	781.82
2012-13	16838.24	19532.86	15.30	0.35	12.14	2552.92	860.86
2013-14	17269.71	19963.75	16.02	0.22	12.36	2873.38	939.53
2014-15	18864.35	20481.63	15.20	0.28	12.64	3294.84	995.79
2015-16	19273.71	20928.38	14.32	0.23	12.87	3308.53	1074.9
CAGR	**6.11**					**19.94**	

Source: Compiled from Power system statistics for various years

KSEB has been taking earnest and sincere efforts to reduce the T&D losses over the year and was able to reduce the loss by 12.87 percent during the period from 2003-04 to 2015-16. It may be observed that increase in requirement of energy could partially be met by way of T&D loss reduction instead of resorting to purchase of costly energy. It is estimated that, there is a saving to the tune of Rs.21074.9 crore till 2015-16 from 2003-04.

2.2.4 Aggregate Technical and Commercial (AT & C) Loss reduction

As the T&D losses was not able to capture all the losses in the network, concept of Aggregate Technical and Commercial losses (AT&C) was introduced. AT&C loss captures Technical as well as commercial losses in the network and is a true indicator of total losses in the system. During 2015-16, AT&C loss has come down to 16.04 per cent while T&D loss has touched 14.37 per cent. The corresponding data of AT&C loss for the country is 23.04 per cent (2013-14). It means that KSEB has made significant achievement in the field of reducing AT&C loss. From 2003-04 onwards, AT&C loss was considerably reduced by way of replacement of faulty meters, intensification of theft detection, installation of new substations and lines, up gradation and modernization of sub transmission and distribution network through Accelerated Power Development Reforms Programme (APDRP).

The estimated T&D losses were only an intelligent guess and not based on the accurate data. More than 70 percent of the total electricity supply to agriculture sector was un-metered. Hence, estimates of T&D losses were not very reliable to assess the actual technical and financial performance of the power utilities. So, a new concept namely Aggregate Technical and Commercial losses (AT&C) losses was used across various states in the post reforms period. These are calculated combining the technical & non-technical losses and non-recovery of dues. AT&C method is understood as superior over the T&D losses. By using this method, it is convenient to make a comparison of various states about their overall financial position. The performance of power utilities about AT&C is presented in the Figure 2.6

Table: 2.9

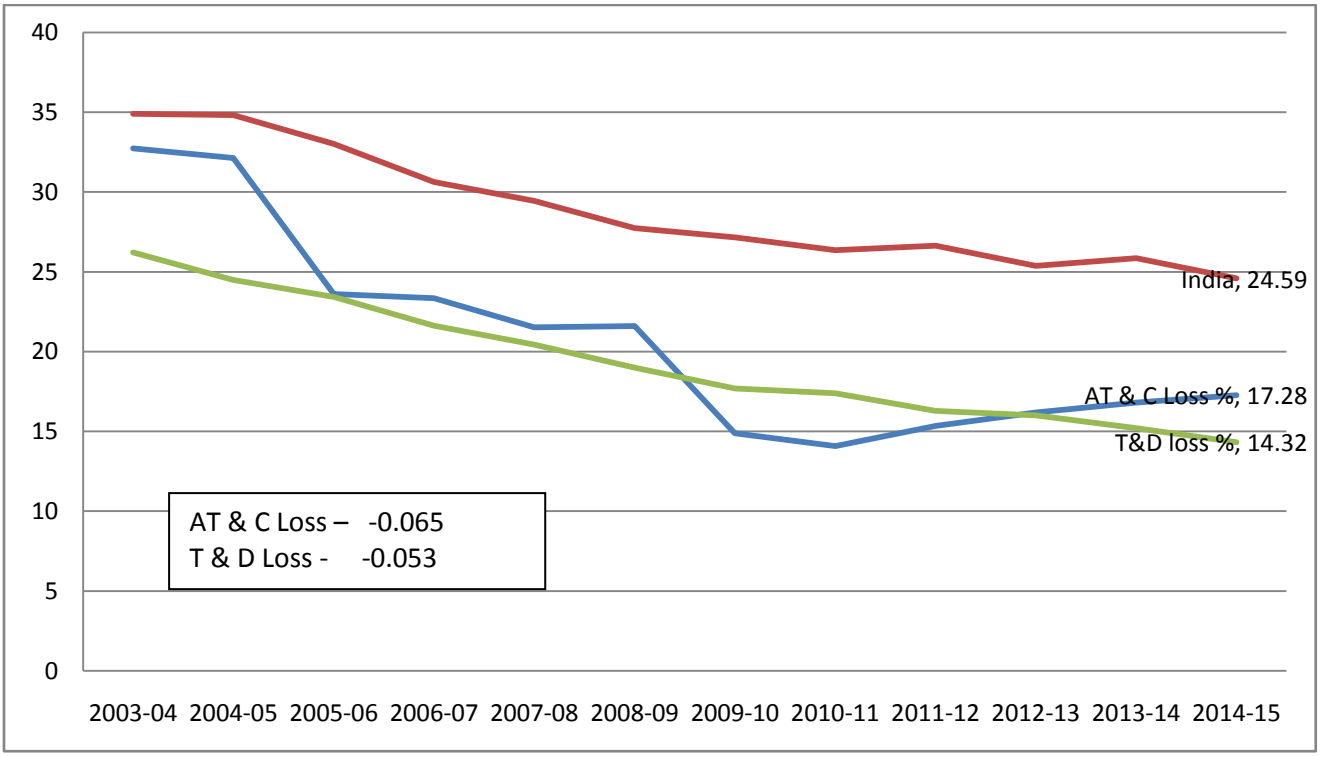
AT & C Loss reduction (in %)

Year	AT & C Loss	T & D Loss	All India
2003-04	32.73	26.22	34.90
2004-05	32.12	24.5	34.82
2005-06	23.61	23.43	33.02
2006-07	23.34	21.63	30.62
2007-08	21.52	20.45	29.45
2008-09	21.61	19	27.74
2009-10	14.89	17.7	27.15
2010-11	14.09	17.4	26.35
2011-12	15.35	16.28	26.63
2012-13	16.20	16	25.38
2013-14	16.82	15.2	25.86
2014-15	17.28	14.32	24.59
CAGR	**-0.065**	**-0.053**	**-0.032**

Source: State Power Utility (2003-04 to 2014-15)

Figure 2.6 shows that in the recent years, there are some improvements in the reduction of AT&C losses. The Compound Annual Growth Rate is negative (-0.065) in the case of Kerala and India is (-0.032). The most contributing factor towards loss reduction is the improvement in the recovery of dues from consumers. As stated earlier the recovery of dues has increased substantially. Consequently, the AT&C losses have been showing decreasing trends. However, the technical and non-technical losses are still very high. So the distribution company should focus more in order to reduce these technical and non-technical losses. It can be done through renovation and modernisation of transmission and distribution system. Ministry of Power (Govt. of India) has been providing financial support under its programme namely Accelerated Power Development and Reforms Programme (APDRP). Therefore, such initiative may be utilised so that the loss level is further reduced in the state. In order to reduce the commercial losses, adequate focus is required to ensure accurate metering and billing process.

Figure: 2.6
AT & C Loss reductions



Source: Compiled from State Power Utility for various years

2.2.5 Electricity Generation Performance

The electricity generation target for the year 2014-2015 was fixed as 1023 Billion Unit (BU). i.e. growth of around 5.77 percent over actual generation of 967.150 for the previous year (2013-2014). The generation in 2014 was 679.063 BU as compared to 639.163 BU generated in 2013, representing a growth of about 10.76 percentage.

Table 2.10
Electricity Generation Performance

Year	Target	Achievement	% of target	% growth
2009-10	789.511	771.551	97.73	6.6
2010-11	830.757	811.143	97.64	5.56
2011-12	855.000	876.887	102.56	8.11
2012-13	930.000	912.056	98.07	4.01
2013-14	975.000	967.150	99.19	6.04
2014-15	998.063	979.946	104.25	10.76

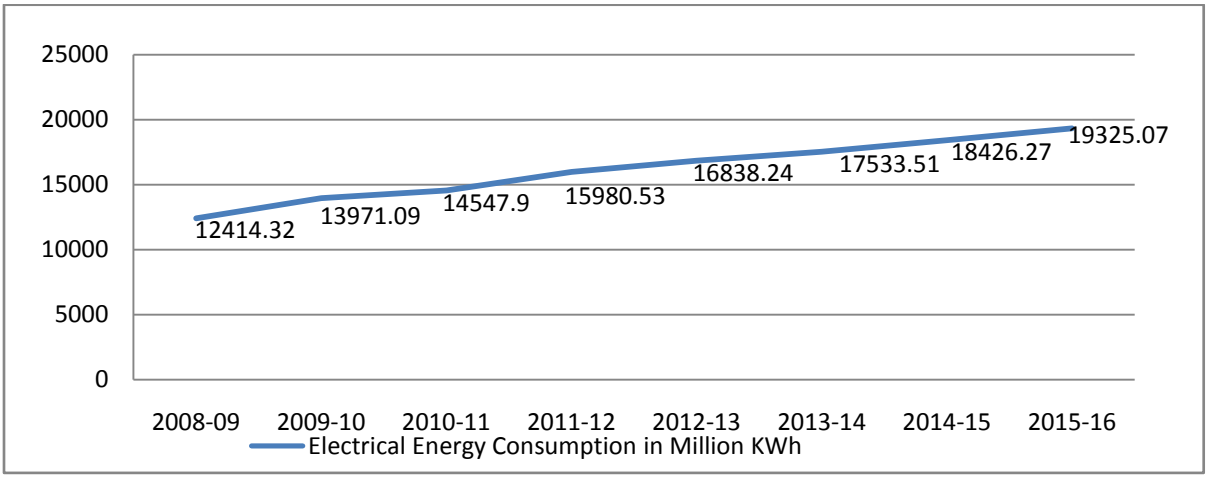
Source: Compiled from Kerala State Electricity Board for various years

2.2.6 Electrical Energy Consumption

In Kerala, annual electrical energy consumption has increased to 19,325.07 MU in 2015-16 from 18,426.27 MU during 2014-15 with an increase of 4.87 percent. Electrical Energy consumption in Kerala during 2011-12 to 2015-16 is depicted in Figure 2.7

Figure 2.7

Electrical Energy Consumption in million kWh



Source: Compiled from State Power Utility for various years

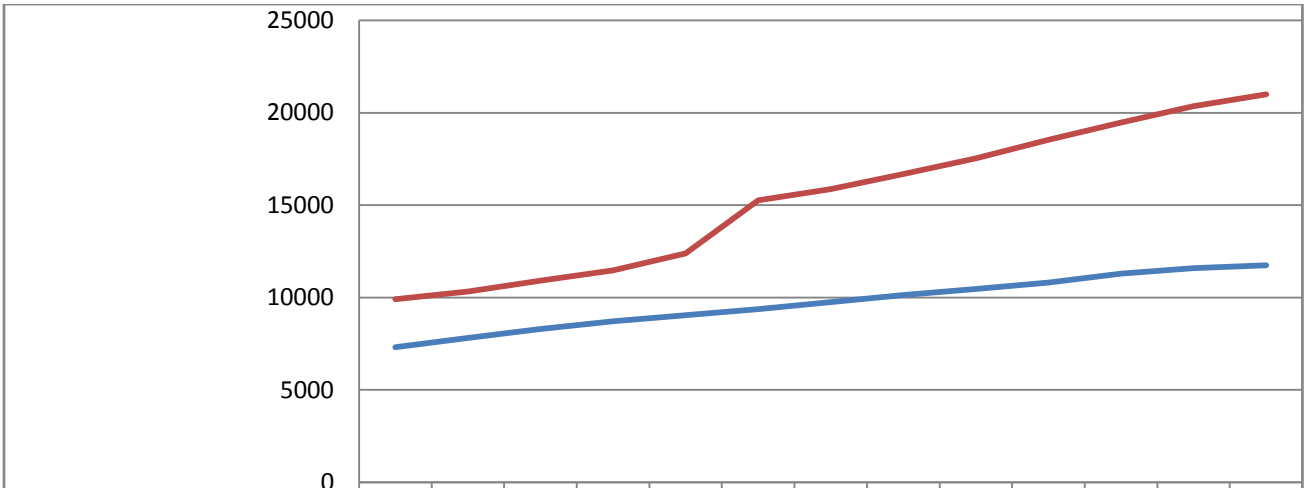
Purchase of power is an important means by which Kerala's energy requirements are met. To this end, KSEB has entered into Power Purchase Agreements with various Central Generating Agencies like NTPC and Neyveli Lignite Corporation (NLC) envisaged for Southern Region. This includes purchase of 229 MW of power from nuclear power stations and 1244.6 MW of power from various thermal stations for the year 2015-16. As a measure to encourage non-conventional sources of energy, KSEBL has executed PPAs for purchase of power from Wind Energy Projects Agali (18.60 MW) &Ramakkalmedu (14.25MW) and from small Hydro Projects Meenvallam (3MW), Iruttukkanam (3 MW), Karikkayam (10.5 MW), Ullunkal (7 MW) and Iruttukanam (4.5 MW). Power is also being purchased from co-generation plant of MPS steel (10MW) and RGCCPP, Kayamkulam (359MW).

2.2.7 Consumers and Connection Load

The number of consumers and connected load during various years are given in Figure 2.8.

Figure 2.8

Consumers and Connection Load



	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16
Consumers ('000)	7300	7799	8295	8713	9033	9363	9743	10127	10457	10806	11287	11592	11742
Connection Load (MW)	9910	10333	10907	11465	12378	15267	15866	16681	17518	18523	19457	20354	20988

Source: Compiled from Power system statistics for various years

Figure 2.8 shows consumers and their usage of electricity connection load. Numbers of electricity consumers are growing at fast rate which leads to energy requirement at two times faster than population growth. It reflects that production of electricity has to be increased or electricity to be conserved in our consumption, otherwise face electricity crisis in near future.

2.3 FINANCIAL PERFORMANCE OF KSEB

The variables related to the financial performance such as the cost of supply of electricity and its various components such as average tariff and revenue realization (including consumer category-wise tariff), unit cost-revenue comparison, commercial profit & loss, subsidies & cross subsidization, net internal resources, rate of return, revenue arrears and other related parameters have been analyzed.

Overall profitability of a project depends upon its technical and financial performance. A utility having sound financial health only can attract adequate investment for its development. A utility is said to be financially viable if it is able to fully recover its operating expenses and earn a reasonable rate of return on its net capital base. After independence, in the power sector more focus was to boost up the generation capacity to meet the increasing demand for power. Therefore, initially respective state governments made huge investment to expand the transmission and distribution network. As stated in earlier, about 30 percent or more of total plan expenditure was spent on the development of power sector. However, because of emergence of other priorities, it was not feasible for the state government to spare the larger budgets for the electricity sector. It was realised that SEBs should be made commercially viable and self sustainable entities. In this regard, an amendment to the electricity (supply) act, 1948 was made requiring respective SEB to earn a rate of return not less than 3 percent on its net capital base after meeting all its operating expenses.

But the financial performance of the most of the SEBs including KSEB does not remain very attractive over the period of time. Because of their inability to generate revenue surplus, the commercial losses increased rapidly. Under the pressure of state government, the tariff for some category of consumers such as agriculture and domestic sector was kept very low in comparison to the cost of supplying power. In this section, the financial performance of the KSEB is analysed. A comparison of the cost of supply and average revenue realised from various consumers has been undertaken. It also examines the adequacy of average electricity tariff to recover the cost of supply from various categories of consumers. Finally, the

success of state government in paying the promised subsidy on account of subsidised power supply to farm sector is also examined.

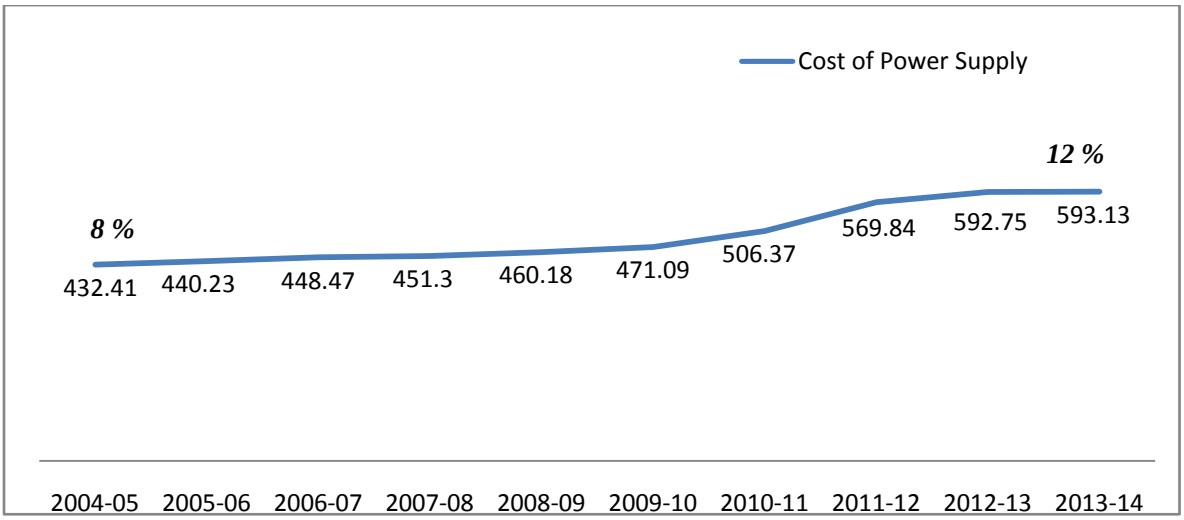
2.3.1 Cost of Power Supply

The cost of supply of electricity represents the cost incurred by the utility to supply electricity to ultimate consumers. The components of cost of supply include Operation & Maintenance expenditure, establishment & administration cost, interest payment liability, depreciation, fuel cost and expenditure on power purchase. The fuel cost incurred by the utilities is accounted for in the calculation of the total cost of supply only in states where the generation and distribution are still integrated under a single company. For states where generation and distribution are unbundled, instead of the fuel cost, the cost of power purchase has been indicated.

The average cost of supply per unit of electricity sold has been progressively increasing over the years. The cost of supply has increased to 570 paisa per kWh sold in 2011-12 from 263 paisa per kWh sold in 1998-99, implying an annual growth rate of 6.1 per cent. The cost of supply per unit sold is shown below Figure 2.9.

Figure: 2.9

Cost of Power Supply (Paisa/kWh sold) from 2004-05 to 2013-14



Source: Compiled from Annual Report of KSEB for various years

The increase in the total cost of supply could be attributed mainly to the rise in interest payment, establishment and administration expenses and expenditure on power purchase

2.3.2 Debt Liabilities of KSEB

As may be seen from the following table, by restricting the fresh borrowings and repaying the debts promptly, the Board has substantially reduced the outstanding debts.

Table: 2.11

Outstanding loan liabilities (RS in Crore)

year	Loan Outstanding	Loan Received	Repayment	Closing Balance	Increase over Previous Year	Interest due for payment	Increase in interest over previous year
2004-05	5355.65	582.15	1396.48	4541.32	-814.3	549.55	-73.29
2005-06	4541.32	379.44	1207.15	3713.62	-827.7	478.91	-70.64
2006-07	3713.62	41.09	1256.19	2498.52	-1215.09	329.67	-149.24
2007-08	2498.52	3.08	644.88	1856.72	-641.8	244.53	-85.14
2008-09	1856.72	94.49	850.85	1100.37	-756.35	164.01	-80.52
2009-10	1100.37	991.98	682.86	1409.49	309.12	123.03	-40.98
2010-11	1409.49	1778.53	2121.52	1066.5	-342.99	115.77	-7.26
2011-12	1066.50	1380.26	1090.42	1356.34	289.84	104.77	-11.00
2012-13	936.38	1298.87	1135.63	1232.73	-123.61	96.97	-7.8
2013-14	985.81	1338.45	1275.59	1076.84	-155.89	87.63	-9.34

Source: Compiled from Power System Statistics for various years

2.3.3 Revenue Gap

It is clear from table 2.12 that the income and expenditure of KSEBL is less than the expenses. Hence it shows revenue deficit during the study period (2004-05 to 2007-08), the revenue deficit showed a decreasing trend. In 2004-05, it was -342.76 and decreased to -91.29 in 2007-08. From 2008- 09 onwards, the gap was increasing. The generated revenue is insufficient to meet the expenses occurred by KSEBL. In 2008-09, the revenue gap was -749.17 and it is increased to -2136.68 in 2013-14.

Table: 2. 12

Revenue Gap (Rs in Crore)

year	Income			Total Expenditure	Revenue Gap
	Tariff	Non-tariff	Total		
2004-05	2917.36	339.65	3257.01	3599.77	-342.76
2005-06	3367.30	325.43	3692.73	3837.32	-144.58
2006-07	4009.70	406.47	4416.17	4558.40	-142.23
2007-08	4696.95	438.89	5135.84	5227.13	-91.29
2008-09	4893.02	456.79	5349.82	6098.99	-749.17
2009-10	4747.17	436.69	5183.86	6411.37	-1227.51
2010-11	5198.52	496.91	5695.43	6925.06	-1229.63
2011-12	5593.02	450.90	6043.92	7978.04	-1934.13
2012-13	5948.82	483.82	6552.86	8599.75	-2046.89
2013-14	6385.70	521.76	6939.79	9076.47	-2136.68

Source: Compiled from Power System Statistics for various years

2.3.4 Subsidy and cross subsidy

As pointed out earlier Kerala State Electricity Board Limited is responsible for carrying out the business of Generation, Transmission and Distribution of electricity in the State of Kerala (kseb.in). However, KSEB Ltd has been granting approval to the embedded open access consumers for purchase and sale of power through open

access as per Kerala Intra State open Access Regulations 2013. Accordingly, the embedded open access consumers are now buying considerable quantum of power from outside the State through open access. The open access customers has availed about 142.00 MU from outside the State of Kerala through open access in 2015-16 and about 119.45 MU in 2016 (National Tariff Policy 2016-17).

KSEB Ltd has however, tied up power through long term as well as medium term contracts, considering the overall growth of demand of all consumers in the State including the growth in demand of the embedded open access consumers. This has resulted in stranded generation capacity and under recovery of fixed cost due to the absence of additional surcharge imposed by the Kerala State Regulatory commission in the State. At present there is decreasing cross subsidy surcharge for the HT & EHT consumers. This has resulted in considerable financial loss to KSEBL, on account of: The absence of cross subsidy component that could have been recovered from these consumers when they avail power through open access. In exercise of the powers conferred by section 181 of the Electricity Act, 2003 (kseb.in), and all other powers enabling it in this behalf Kerala State Electricity Regulatory Commission notified the Kerala State Electricity Regulatory Commission (Connectivity and Intrastate Open Access) Regulations, 2013, herein after called "Regulations 2013". As per Section 40 of KSERC Regulations, 2013, if open access facility is availed of by a subsidizing consumer of a distribution licensee of the State, then such consumer, shall, pay cross subsidy surcharge as determined by the Commission. Cross subsidy surcharge determined on per unit basis shall be payable, on monthly basis, by the open access customers based on the actual energy drawn during the month through open access. The amount of surcharge shall be paid to the respective distribution licensee of the area of supply from whom the consumer was availing supply before seeking open access.

National Electricity Policy lays down the amount of cross-subsidy surcharge and the additional surcharge to be levied from consumers. Section 8.5 of National Tariff Policy 2016 stipulates that: "A consumer who is permitted open access will have to make payment to the generator, the transmission licensee whose transmission systems are used, distribution utility for the wheeling charges and, in addition, the

cross subsidy surcharge. SERCs may calculate the cost of supply of electricity by the distribution licensee to consumers of the applicable class as aggregate of : (a) Per unit weighted average cost of power purchase including meeting the Renewable Purchase Obligation; (b) Transmission and distribution losses applicable to the relevant voltage level and commercial losses allowed by the SERC; (c) Transmission, distribution and wheeling charges up to the relevant voltage level; and (d) Per unit cost of carrying regulatory assets, if applicable"

2.3.5 Legal framework and Regulatory Development

The relevant provisions of Electricity Act 2003, Policies of Government of India and KSERC regulations on open access are shown. The Electricity Act 2003 provides following provisions wherein the powers have been given to State Commissions for specifying cross subsidy surcharge. "The State Commission shall introduce open access in such phases and subject to such conditions, (including the cross subsidies, and other operational constraints) as may be specified within one year of the appointed date by it and in specifying the extent of open access in successive phases and in determining the charges for wheeling, it shall have due regard to all relevant factors including such cross subsidies, and other operational constraints: Provided that such open access shall be allowed on payment of a surcharge in addition to the charges for wheeling as may be determined by the State Commission: Provided further that such surcharge shall be utilised to meet the requirements of current level of cross subsidy within the area of supply of the distribution licensee: Provided also that such surcharge and cross subsidies shall be progressively reduced in the manner as may be specified by the State Commission: Provided also that such surcharge shall not be liveable in case open access is provided to a person who has established a captive generating plant for carrying the electricity to the destination of his own use: to provide non-discriminatory open access to its transmission system for use by- (i) any licensee or generating company on payment of the transmission charges; or (ii) any consumer as and when such open access is provided by the State Commission under sub-section (2) of section 42, on payment of the transmission charges and a surcharge thereon, as may be specified by

the State Commission: Provided that such surcharge shall be utilised for the purpose of meeting the requirement of current level cross-subsidy:

The Act provides following provisions related to 'Additional Surcharge'. Where the State Commission permits a consumer or class of consumers to receive supply of electricity from a person other than the distribution licensee of his area of supply, such consumer shall be liable to pay an additional surcharge on the charges of wheeling, as may be specified by the State Commission, to meet the fixed cost of such distribution licensee arising out of his obligation to supply.

2.4 Ratio analysis of Kerala State Electricity Board

Ratio analysis is the most efficient tool used for analysing the efficiency of financial management of any business organisation. Various types of ratios have been computed to analyse the short term as well as long term financial position of the KSEB.

This part is divided into two sections. Section 1 analyses the short term financial ratios. Various ratios such as current ratio, quick ratio, cash ratio, working capital ratio, etc. have been discussed. In Section .2, key financial ratios such as asset turnover ratio, rate of return, etc. have been used for evaluating the long term financial position.

2.4.1 Short Term Financial Performance of the KSEB

The short term financial position gives the overall financial and administrative efficiency of an organisation. Generally, two techniques are commonly used to analyse the short term financial performance i.e., Liquidity Ratio and Net Working Capital.

2.4.1.1 Liquidity ratio

To measure the short term financial performance, various figures related to the short term liquidity are calculated. These ratios indicate the degree of liquidity of the organisation. Therefore, these ratios are defined as liquidity ratios.

Liquidity ratio establishes the relationship between current assets including cash in hand to the current liabilities of the organisation. It is also defined as a quick measure used for assessing the liquidity position of an entity. It measures the ability of an organisation to meet its current liabilities such as bills payable, short term bank loans, income tax liability, etc. Current Ratio, Quick Ratio and Cash Ratio are the most commonly used liquidity ratios. The position of KSEB in maintaining these ratios is explained below:

2.4.1.1.1 Current Ratio: It examines the current position of the utility and assesses the efficiency level achieved in using the current assets. In other words, it establishes the relationship between current assets and current liabilities. Current resources include cash in hand and the assets which can easily be converted into cash within a period of one year. These include bank balance, loans and advances, sundry receivables, etc. Current liabilities include the outstanding expenses which are incurred within one year. Bills payable, short term bank loans, income tax liability, etc. The commonly used rule for the current ratio is 2:1. It implies that the current assets of an organisation should be twice the current liabilities. Only then, the entity is stated to be in solvent position. Mathematically it is defined as:

Current ratio = Current assets/ Current liabilities

The current ratio maintained by Kerala State Electricity Board (KSEB) from 2004-05 to 2014-15 is presented in the Table 2.13.

Table 2.13

Current Ratio of Kerala Power Utility (Rs in Crore)

Financial Year	Current Assets	Current Liabilities	Current Ratio
2004 - 05	2118	4603	0.46
2005 – 06	2046	4945	0.41
2006 – 07	2127	5015	0.42
2007 – 08	2151	5213	0.41
2008 – 09	2113	6059	0.35

2009 – 10	2239	5621	0.40
2010 – 11	2330	5782	0.40
2011 – 12	2372	6281	0.38
2012 – 13	2152	8092	0.27
2013 – 14	2356	7753	0.30
2014 - 15	2215	6248	0.35

Source: Compiled from Annual statement of accounts of KSEB for various years.

The Table 2.13 reveals the current ratio of KSEB was 0.46 in the FY 2004 – 05, which is the highest during the study period. And after that, it has been declining over the period from FY 2004 - 05 to 2014 – 15. This shows a positive margin of safety for creditors. However, it does not satisfy the condition of required benchmark i e 2:1.

2.4.1.1.2 Quick Ratio: Quick ratio express the relationship between the quick assets and the current liabilities. An asset is said to be liquid if it can be converted into cash immediately without any loss to the value of the asset. It includes cash, bank balance, loan and advances, receivables against supply of power and sundry receivables.

Table 2.14

Quick Ratio Analysis for the Kerala Power Utility (Rs in Crore)

Financial Year	Current Assets (in Crores)	Inventories (in lakhs)	Quick Assets (in crores)	Current Liabilities (in crores)	Quick Ratio*
2004 – 05	2118	14551.34	6629.66	4603	1.44
2005 – 06	2046	15392.93	5068.07	4945	1.02
2006 – 07	2127	19352.25	1923.75	5015	0.38
2007 – 08	2151	18165.47	3346.53	5213	0.64
2008 – 09	2113	17946.93	3184.07	6059	0.53
2009 – 10	2239	18295.24	4097.76	5621	0.73
2010 – 11	2330	20442.59	2860.41	5782	0.49

2011 – 12	2372	20848.36	2872.64	6281	0.46
2012 – 13	2152	25738.18	-4213.18	8092	-0.52
2013 – 14	2356	27805.42	-4238.42	7753	-0.55
2014 – 15	2215	23990.26	-1838.26	6248	-0.29
2015 – 16	2492	29010.86	-4085.86	5752	-0.71

Source: Compiled from Annual statement of accounts of KSEB for various years.

* Quick assets are calculated by deducting inventories from current assets

Quick Ratio=Quick assets/current liabilities

The quick ratio was in the range of 1.44 to 0.29 during the study period. After 2011 – 12, it started determining as in clear from negative figures. The Table exhibited that the position of KSEB became worse in that period. In other words quick assets were more than current liabilities in the initial years. It was a sign of good financial health but after 2011-12 periods the position was reversed. Hence the agencies should take corrective measures to control it.

2.4.1.1.3 Cash Ratio: Cash ratio may be defined as the relationship between the cash including bank balance to the current liabilities. It can be calculated dividing cash & bank Balance by the current liabilities. It is deemed to be satisfactory when it 0.5:1 or nearer to it.

Cash ratio=Cash& Bank balance/current liabilities

Table: 2.15

Cash Ratio of the Power Utility of Kerala (Rs in Crore)

Financial Year	Cash & Bank Balance	Current Liabilities	Cash Ratio
2004 - 05	612	4603	0.133
2005 – 06	625	4945	0.126
2006 – 07	637	5015	0.127
2007 – 08	657	5213	0.126

2008 – 09	662	6059	0.109
2009 – 10	671	5621	0.119
2010 – 11	692	5782	0.120
2011 – 12	634	6281	0.101
2012 – 13	780	8092	0.096
2013 – 14	775	7753	0.100
2014 - 15	798	6248	0.128

Source: Compiled from Annual statement of accounts of KSEB for various years.

It is evident from the table 2.15 that, the position of cash ratio was quite adverse over the period of the study. During the study period, the cash ratio was found to be less than satisfactory level (0.5:1) and remaining almost the same between 0.133 and 0.1 to 1. Therefore, the utility should take required steps such as smooth recovery of electricity dues to ensure reasonable good cash ratio so that its liquidity position is improved.

2.4.1.2 Working Capital

Two concepts are commonly used for assessing working capital. First is the gross working capital which is equal to total current assets of the organization and the second is net working capital. Net working capital is calculated by subtracting current liabilities from total current assets. It may be noted that current assets must be in excess of the current liabilities. Only then, there will be net working capital otherwise there will be working capital deficit.

2.4.1.2.1 Gross Working Capital: Gross working capital may be defined as the current assets that can be converted into cash within a short period. It includes stock bill, receivables, cash and bank balance, loans and advances, sundry receivables, inter-unit transfers, etc.

Table 2.16

Position of Gross Working Capital of KSEB (Rs in Crore)

Year	Stocks	Receivable against supply of power	Cash and Bank balance	Loan & advances	Sundry receivables	Working capital
2010 – 11	397(17)	583 (25)	692 (30)	137 (6)	518 (22)	2330 (100)
2011 – 12	393(17)	634 (27)	634 (27)	133 (6)	575 (24)	2372 (100)
2012 – 13	314(15)	541 (25)	780 (36)	127 (6)	388 (18)	2152 (100)
2013 – 14	324(14)	576 (24)	775 (33)	151 (6)	528 (22)	2356 (100)

Source: Compiled from Annual statement of accounts of KSEB for various years.

**Figures in the brackets represent the relative shares in the total working capital for a particular financial year*

As presented in the Table 2.16, in the Cash and Bank balance was the major component of the gross working capital which was reported above 30 percent of total current assets. Receivable against supply of power was reported as second major item of the gross working capital. It was reported above 25 percent. However, in this period the relative share of receivables against supply of power increased drastically. This is because of the improvements shown by KSEB in the collection efficiency.

2.4.1.2.2 Net Working Capital

Net working capital may be defined as the difference of total current assets and total current liabilities. Therefore current assets must exceed the current liabilities. Only then, the net working capital will be positive. Otherwise, there will be negative working capital or working capital deficit.

Table 2.17

Trend of Net working Capital in KSEB (in Crore)

Financial Year	Current Assets	Current Liabilities	Net working capital
2004 - 05	2118	4603	-2485
2005 – 06	2046	4945	-2899

2006 – 07	2127	5015	-2888
2007 – 08	2151	5213	-3062
2008 – 09	2113	6059	-3946
2009 – 10	2239	5621	-3382
2010 – 11	2330	5782	-3452
2011 – 12	2372	6281	-3909
2012 – 13	2152	8092	-5940
2013 – 14	2356	7753	-5397
2014 - 15	2215	6248	-4033

Source: Compiled from Annual statement of accounts of KSEB for various years.

Table 2.17 presents that net working capital is negative all through the years. The working capital deficit was reported to be Rs. -4033 core in the FY 2014 – 15 which is not a good indicator of the financial health. The utility should focus more in increasing its current assets share, timely recovery of dues and other charges and to reduce the unproductive expenditures.

2.4.2 Long Term Financial Performance

Long term financial position refers to the ability of the organisation to repay its long term debts and interest liabilities. To measure the long term financial position, a researcher should examine the structure of capital formation of the organisation, capital employed and its various trends, ratios such as asset turnover ratio, profitability ratio, rate of return, etc.

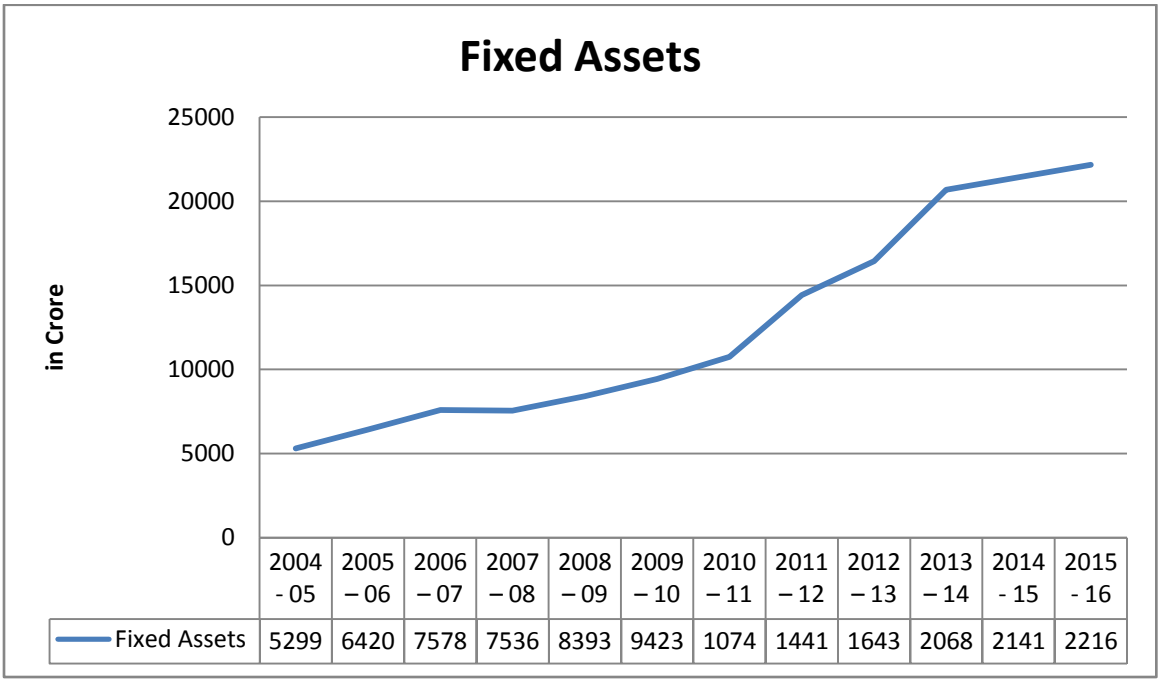
2.4.2.1 Capital formation of the Board

Last ten year data shows KSEB did not own any capital in the form of equity. All the capital of the utility was in the nature of borrowings mainly from the State Government. Section 12 (A) of the Electricity supply Act 1948 empowered the respective state government to notify the SEB as a body corporate with a capital not exceeding the limit of Rs.10 crore.

2.4.2.2 Analysis of fixed Assets

This is an important aspect of the long term financial position of the utility. The investments in fixed assets involve commitments of funds for long period in the future. Fixed assets may be in the form of net asset, capital expenditure in progress, assets not in use, deferred expenses and investments. The position of KSEB regarding fixed assets is as under:

Figure 2.10 Fixed Assets of the KSEB (Rs in Crore)



	2004 - 05	2005 – 06	2006 – 07	2007 – 08	2008 – 09	2009 – 10	2010 – 11	2011 – 12	2012 – 13	2013 – 14	2014 - 15	2015 - 16
Fixed Assets	5299	6420	7578	7536	8393	9423	1074	1441	1643	2068	2141	2216

Source: Compiled from Annual statement of accounts of KSEB for various years.

It is clear from the Figure 2.10 that the fixed assets of KSEB have been showing increasing trend. The fixed asset was reported to be Rs. 529 crore in 2004 - 05 doubled in 2010 – 11 and it is increased into Rs. 2216 crore in 2015 – 16. It is approximately four times higher than the level in 2004 - 05.

2.4.2.3 Activity Ratio

Activity ratio involves the relationship between the sales and the assets. It is calculated to examine the effectiveness of the assets utilization. Several ratios are commonly used to assess the efficient use of assets such as inventory turnover ratio,

debtor's turnover ratio and assets turnover ratio. Due to limited information we analysed only assets turnover ratio

2.4.2.4 Assets turnover ratio

Assets turnover ratio may be defined as the relationship between the sales and the assets. It is of two types fixed assets turnover ratio and current assets turnover ratio.

2.4.2.4.1 Fixed assets turnover ratio

Fixed assets turnover ratio is defined as a relationship between the sales and the fixed assets. It can be computed by dividing the sales by fixed assets. Higher the ratio better the financial health of the utility

Fixed assets turnover ratio=sales/Fixed assets

Table 2.18

Fixed Assets Turn Over Ratio (Rs in Crore)

Financial Year	Sales	Fixed Assets	Fixed assets Turnover ratio
2004 - 05	2917	5299	0.55
2005 – 06	3367	6420	0.52
2006 – 07	4009	7578	0.53
2007 – 08	4696	7536	0.62
2008 – 09	4893	8393	0.58
2009 – 10	4747	9423	0.50
2010 – 11	5198	10744	0.48
2011 – 12	5593	14416	0.39
2012 – 13	7223	16438	0.44
2013 – 14	9974	20685	0.48
2014 - 15	10116	21416	0.47
2015 - 16	10914	22164	0.49

Source: Compiled from Annual statement of accounts of KSEB for various years.

It is clear from the Table 2.18 that fixed assets turnover ratio showed decreasing trends during the period under consideration.

2.4.2.4.2 Current Assets Turn Over Ratio

Current assets turnover ratio is defined the relationship between current asset and the sales.

Current asset turnover ratio= Sales/ Current Asset

Table 2.19

Current assets turnover ratio (Rs in Crore)

Financial Year	Sales	Current Assets	Current assets Turnover ratio
2004 - 05	2917	2118	1.38
2005 – 06	3367	2046	1.65
2006 – 07	4009	2127	1.88
2007 – 08	4696	2151	2.18
2008 – 09	4893	2113	2.32
2009 – 10	4747	2239	2.12
2010 – 11	5198	2330	2.23
2011 – 12	5593	2372	2.36
2012 – 13	7223	2152	3.36
2013 – 14	9974	2356	4.23
2014 - 15	10116	2215	4.57
2015 - 16	10914	2118	5.15

Source: Compiled from Annual statement of accounts of KSEB for various years.

The Table 2.19 presents that the current assets turnover ratio has improved after the initiation of power sector reforms. It was reported to be 1.38 in the FY 2004 - 05. It increased to 2.32 in the FY 2008-09. In the FY 2015 - 16, it was reported to be 5.15. It was always greater than 2.00 in the post reforms period.

2.5 Performance of Power Sector Agencies

Power development activities in the State are carried out mainly through four agencies viz, Kerala State Electricity Board Limited (KSEBL), Agency for Non-conventional Energy and Rural Technology (ANERT), Electrical Inspectorate and Energy Management Centre (EMC). The Outlay and Expenditure of these departments for the last two years of the 12th Plan are shown in Table 2.20

Table: 2.20

Outlay and Expenditure (in lakh)

Department	Annual Plan 2015-16			Annual Plan 2016-17		
	Outlay	Expenditure	Per cent of Exp	Outlay	Expenditure*	Per cent of Exp
KSEBL	140942	105005.35	74.50	156412	68,378.42	43.72
ANERT	4280	2107.71	49.25	4388	2.41	0.05
MTSL	560	354.82	63.36	730	1.63	0.22
EMC	938	751.21	80.09	740	230.98	31.21
Total	146720	108219.09	73.76	162270	68,613.44	42.28

Source: KSEB, Expenditure as on December, 2015-16

2.5.1 Kerala State Electricity Board Limited (KSEBL)

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.

In order to comply with the provisions of Electricity Act 2003 and the Government of India directives, the Kerala Government notified a transfer scheme through which all assets and liabilities of KSEB were vested with the State Government. The assets and liabilities were revised with fully owned government company, KSEB Limited under the Indian Companies Act, 1956.

Table: 2.21 Details of category wise energy consumption in MU

Category	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13
LT Category									
Domestic	4463	4728	5213	5602	5931	6559	6878	7706	8313
Commercial	1097	1169	1245	1378	1502	1793	1951	2141	2224
Industrial	838	904	933	984	1015	1064	1054	1097	1102
Agricultural	197	209	220	230	225	257	232	286	306
Street lightes	198	207	228	248	294	303	265	294	313
SubTotal LT	6793	7217	7841	8444	8968	9976	10380	11525	12258
HT Category									
HT I Industrial	1356	1409	1436	1461	1326	1450	1516	1596	1683
HT II Non Industrial	123	128	134	138	107	117	102	116	126
HT IIB	0.08	0.09	0.09	0.10	0.09	0.09	0.09	0.10	0.11
HT III Agriculture	9.51	9.45	9.36	9.23	8.76	8.00	8.00	8.11	8.35
HT IV Commercial	359	402	431	507	579	693	756	867	871
EHT 66/110/220 KV	1109	1089	1070	1025	966	1149	1181	1243	1218
Railway Traction	60	63	72	109	142	165	157	155	174
Bulk Supply	278	303	335	357	318	413	448	472	501
Subtotal HT	3295	3404	3489	3605	3447	3995	4168	4456	4580
Total	10088	10621	11331	12050	12414	13971	14548	15981	16838

Source: Compiled from Annual Reports of KSEB for various years

LT category of consumers only domestic consumers are increased 8.8 percent to 9.28 percent in the period 2004-05 to 2013-14 all other categories are declining growth percentage. In the case of HT consumers categories only Non industrial consumers are increasing the consumption percentage 8.3 percent to 12.5 percent during the last ten years.

2.5.2 Pattern of Power Consumption

The domestic category consumers showed a reasonable growth of 4.27 percentages to 7760645 in 2009-10 from 7443028 in 2008-09. But LT & HT Commercial category consumers registered an increase of 4.71 percentages over 2008-09. Growth of other agricultural pumping, Licensees (Bulk supply) also increased substantially over the year. The sale of energy has increased corresponding to the increase of total consumers. During 2009- 10, 14047.75 MU of energy was sold showing an increase of 1170.1 MU as compared to the 2012 (12877.65 MU), the annual consumption and maximum demand will be 19230 MU and 3528 MW respectively.

Kerala's consumption is predominantly domestic, which account for 51 per cent of the total consumption. Revenue from Domestic consumers is only 36 per cent of the total revenue. The domestic category consumers showed a growth rate of 1.52 per cent from 89,87,947 in 2014-15 to 91,24,747 in 2015-16. Per capita consumption has increased by 3.86 percent that is, to 565 KWh in 2015-16 against 544kWh in 2014-15. During 2015-16, 19,325 MU of energy valued at 10,44,601 lakh was sold (internally) showing an increase of 899 MU as compared to the previous year's 18,426 MU. Total consumption and per capita consumption of electricity in Kerala show a fluctuating pattern of growth. The details of consumption of electricity in Kerala for the years 2011-12 to 2015-16 is given in Table 3.13 and the details of the pattern of power consumption and revenue collected during 2015-16.

Table: 2.22

Pattern of power consumption and revenue collected during 2015 -16

Category	No of consumers	% of consumers to total	Consumption (MU)	Consumption as % of total	Revenue collected (lakh)	Revenue as % of total
Domestic						
Paying group Non paying group	9124747	78.20	9943.5	51.45	374410	35.84
Commercial including general	1923402	16.48	2735.36	14.15	244850	23.44
Industrial LT	136693	1.17	1103.23	5.71	74663	7.15
HT and EHT	5005	0.04	4106.00	21.25	281690	26.97
Public lighting	4281	0.04	366.62	1.90	15636	1.50
Railway Traction	9	0	212.83	1.10	12086	1.16
Agricultural Pumping	473882	4.06	279.48	1.45	6562	0.63
Licensees (Bulk Supply)	12	0	578.08	2.99	34704	3.32
Others			0	0	0	0
Outside Supply			0	0	0	0
Total	11668031	100	19325.10	100	1044601	100

Source: Annual Report, KSEBL, 2015-16

Table: 2.23

Consumption of Electricity in Kerala

Year	Total Consumption of Electricity (MU)	Growth Rate (%)	Per Capita Consumption of Electricity (kWh)	Growth Rate (%)
2011-12	15981		478	
2012-13	16838	5.36	501	4.8
2013-14	17454	3.65	516	2.9
2014-15	18426	5.5	544	5.4
2015-16	19325	4.8	565	3.8

Source: Economic Review 2015-16

The category wise number of consumers for the period from 2004-05 to 2013-14 is detailed in table 2.24.

Table 2.24

Category wise details of LT consumer strength

Year	Domestic	Commercial	Industrial	Agricultural	Street Lights	Subtotal LT
2004-05	5626936	1157314	119268	453379	2132	7359029
2005-06	6364223	1224975	121317	466831	2234	8179580
2006-07	6880500	1270932	122308	435673	2325	8711738
2007-08	7137739	1327978	122449	440958	2325	9031449
2008-09	7481601	1324934	119871	431745	2729	9360880
2009-10	7790132	1387345	122325	437877	2927	9740606
2010-11	8092072	1455790	127354	446460	3038	10124714
2011-12	8324961	1538786	132051	455078	3160	10454036
2012-13	8573938	1633689	131583	460263	3505	10802978
2013-14	8971947	1632736	130361	427163	3789	11165996
CAGR	**4.78**	**3.50**	**0.89**	**-0.59**	**5.92**	**4.26**

Source: Compiled from Annual Reports of KSEB for various years

Table 2.25

Category wise details of HT consumer strength

year	Industrial	Non Industrial Non Commercial	Agriculture	Commercial	Railway Traction	Bulk Supply	Sub Total HT
2004-05	884	171	54	628	5	10	1788
2005-06	926	184	49	741	6	10	1952
2006-07	946	218	47	867	6	11	2132
2007-08	979	157	47	1069	7	11	2307
2008-09	1052	175	48	1248	8	11	2581
2009-10	1128	179	48	1455	8	12	2870
2010-11	1230	212	50	1678	8	12	3232
2011-12	1321	237	55	1925	8	13	3601
2012-13	1512	263	40	2039	8	12	3912
2013-14	1694	276	36	2259	9	13	2633
CAGR	**6.72**	**4.90**	**-3.97**	**13.66**	**6.05**	**2.66**	**3.95**

Source: Compiled from Annual Reports of KSEB for various years

Table 2.24 and 2.25 shows category wise Low Tension (LT) and High Tension (HT) consumer strength in Kerala. In Kerala more consumers in the category of domestic in 2004-05, the number of domestic consumers was increased with 4.48 of CAGR. In the case of commercial and industrial sector increased w.r.t 3.5 and 0.89 of CAGR. The HT consumers are mainly use in industrial purpose. It has increased in the last ten years CAGR of 6.72.

2.5.3 Agency for Non-conventional Energy and Rural Technology (ANERT)

Agency for Non-conventional Energy and Rural Technology (ANERT) is an autonomous body under the Power Department, Government of Kerala. ANERT is

the nodal agency for the implementation and propagation of non-conventional sources of energy in the State.

The programmes taken up by ANERT includes Solar photovoltaic programmes, Solar thermal programmes, Wind energy programmes, Biogas programmes, Improved Chulha programmes, Publicity and awareness programmes. The assistance from Ministry of New and Renewable Energy (MNRE), Government of India is also available for these schemes based on MNRE guidelines.

Achievements of ANERT have installed 4492 family type bio gas plants under state scheme 2015-16. Further 9 biogas plants above 6m3 were also installed.4561 improved chulhas have been installed under 2015-16 programme (3676 nos. of improved chulha to SC/ST & Total Housing Scheme beneficiaries and 885 nos. under community models). During 2015-16,5720 evacuated tube collector type solar water heating systems of collector area 8580 m2 and 354 flat plate collector based solar water heating systems of solar collector area 708 m2 have been installed and subsidy given to 7335 m2 ETC (Evacuated Tube Collector) based systems and 490m2 FPC (Flat Plate Collector) based systems.

Four major deposit works were executed by ANERT during this period. They are 1) 15 m3 bio gas plant at Mental Health Centre, Thiruvanathapuram 2) 10 m3 Bio gas plant at SAP camp, Thiruvanathapuram 3) 15 m3 Bio gas plant at Govt. Engineering College, Kannur and 4) 6m3 bio gas plant at Police Training College, Thiruvanathapuram. ANERT has conducted 9 training programmes on renewable energy sectors at different levels and 2 training and capacity building programmes for their own staff. 36 exhibitions were also sponsored by ANERT.

ANERT was entrusted with the programmes for renewable energy studies and development programmes in the State. ANERT is also functioning as the State Nodal Agency (SNA) of the central Ministry of New Renewable Energy (MNRE), but owing to various administrative constraints the achievements of ANERT have been badly marred by its rather poor performance during the past plan period. The incompetence of ANERT in carrying out resource and demand assessment studies as

well as working out an overall plan for renewable energy resource development targeting lifeline energy availability to all in the State and the reluctance to support the energy development programmes of Local Self Government Institutions

2.5.4 Energy Management Centre (EMC)

Energy Management Centre (EMC), Kerala is an autonomous body under the Department of Power, Government of Kerala, devoted to the improvement of energy efficiency in the State, promotion of energy conservation and encouraging development of technologies related to energy through research, training, demonstration programmes and awareness creation.

Achievements of Energy Management Centre is energy conservation efforts in the State saved 225.29 MU of electricity, 9610 MT of oil, and 209 MT of LPG. This includes 77 MU total electricity saving by industrial and commercial sector, savings in domestic sector was 147 MU, savings in demonstration projects was 0. 124 MU and implementation of energy audit recommendation was 1.17 MU. Similarly, the savings in Oil and LPG by Industrial and commercial consumers were 9610 MT and 209 MT. Energy Management Centre (EMC) has won three prestigious awards i) Second Best State Designated Agency, by Ministry of Power, Govt. of India ii) For implementation of PICO hydel projects, from MNRE, Govt. of India iii) Certificate of Appreciation from UNDP/GEF/BEE for creating awareness on Energy Conservation Building Code (ECBC).

As part of Energy clinic programme, 372 women across 9 districts were given training. 680 Energy Clinics were conducted which covered about 10,200 consumers across the state. Energy Clinic (EC) is a novel programme of EMC for energy conservation activities in the domestic sector through women as agents of change for creating energy conservation awareness among women. Energy Clinic is the first of its kind at state level, promoting the value of contributions that women can make through energy conservation.

70 schools selected in the State for making them energy efficient by providing energy efficient appliances like star rated ceiling fan, LED and T5 Tube. 300 awareness classes were taken by trained resource persons (RPs); 124 RPs trained and deputed by Energy Management Centre across the State.

2.5.5 Kerala State Electricity Regulatory Commission (KSERC)

The statutory organization of quasi-judicial nature was established in the year 2002. The Commission has been taking all efforts to bring in an effective and efficient regulatory process in the Power Sector in the State. The Commission held 31 hearings for the disposal of the petitions filed before it in 2016-17. In addition, the Commission held a number of routine internal meetings to transact business relating to administrative matters, framing and finalization of regulations, admission of petitions, Aggregate Revenue Requirement and Expected Revenue from Charges (ARR & ERC) of the licensees and other matter related to the day to day functioning of the Commission.

The challenge of meeting Kerala's energy requirements in the future is significant. Overcoming them however requires careful consideration of the shifts that have taken place over the last several years in this sector. The emergence of power trading through exchanges and the strengthening of the grid at national and regional levels has opened up possibilities that allow overcoming Kerala's capacity addition constraints in new and innovative ways. This applies to both fossil-fuel based as well as non-fossil fuel and renewable energy sources. This new scenario also requires that urgent attention needs to be paid to the transmission and distribution network in terms of ensuring both adequate capacity and efficiency.

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.

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 percent households as electrified.

2.6 POWER SECTOR REFORMS

Reforms in Kerala power sector and KSEB are mandated by Govt of Kerala Power Policy 1988. As a part of implementation of the reform process as envisaged in this policy and to take advantage of the benefits offered by the Govt of India, the Govt of Kerala signed a MoU with the Govt of India on 20-8-2001. Moreover, KSEB has been implementing various reform processes with the positive results of improving quality of energy service to customers and financial health of the Board. The major reform process being undertaken by the Board is as follows. KSEB has targeted to reduce the loss by 2 percent every year. T&D loss brought down to 20.45 percent as on 2009, all villages have been electrified, Completed 100 percent metering of all distribution feeders, All consumers have metered, Energy audit of 11 KV and above metering has been computerised, All 641 sections have been computerised in open source platform, Efficient financial management resulted in reducing the outstanding loan from Rs.1856.72 crore (2008) to Rs.1100.37 crore (2009)

As part of providing electricity to households as social obligation belonging to consumers Below Poverty Line (BPL) at the cost of the KSEB. As part of Demand Side Management activities, an Energy Audit Cell has been formed in KSEB in the year 2007 with an organizational set up for conducting Energy Audit and for taking steps as per provisions of the Energy Conservation Act 2001. As part of this, workshops have been conducted in the thermal, hydro stations for formulating the

action plan for energy audits and for promoting energy conservation activities (Economic Review 2009).

2.6.1 Reforms and Restructuring of Power sector

The Power sector reforms were initiated in 1991 to encourage competition and seek private participation in each sub element of the sector, namely generation, transmission and distribution. Pursuant to this, State Electricity Boards were restructured and unbundled into separate companies for generation, transmission and distribution segments. Independent regulatory commissions at the Central and state level were set up. The enactment of Electricity Act 2003 heralded a new era for the power sector development in India. The Act brought together laws on generation, transmission, distribution, trading and use of electricity, liberalising generation, transmission and distribution and providing for penal action for theft of power or default on payment for power consumed. It also facilitated further reform measures to strengthen the sector. Significant of Govt of India / regulatory initiatives in recent times have been those pertaining to Mega / Ultra Mega Power Generation projects revised tariff regulations for existing central government projects, competitive bidding for all future power generation projects, tariff norms for renewable energy / introduction of Renewable Energy Certificates, new transmission pricing grid code, power market regulations, Re – structured Accelerated Power Development Reform Programme (RAPDRP), National Electricity Fund, etc.

2.6.2 Accelerated Power Development and Reforms Programme (APDRP)

APDRP is one of the lucrative schemes initiated by the Government of India to strengthen the transmission and distribution segment. KSEB has played a vital role to implement this scheme in Kerala since its inception. A total outlay of Rs. 863.62 crores, which includes 3 numbers that is circle schemes (Rs. 148.24 crores), town schemes and city schemes. As far as 46 town schemes are considered, Rs.341.81 crores and for 3 city schemes Rs. 373.57 crores is sanctioned. The development project for cities of Thiruvananthapuram, Kochi and Kozhikode with an outlay of Rs. 373.57 crores is awarded on turnkey basis. The major works include construction of

11 KV UG cables, installation of Ring Main Units, Compact Secondary Substation and distribution Transformers.

The total expenditure is the extent of Rs. 556.59 crores in 2009-10 for all the schemes. Government of India to KSEB through Government of Kerala released an amount of Rs. 139.13 crores and Rs. 115.27 crores as grant and loan respectively. An amount of Rs. 159.12 crores was received from M/s REC Ltd., as counterpart fund. Details of scheme outlay and expenditure are shown in Table 2.26

Table 2.26

Financial Achievement under ADDRP Scheme

Name of Scheme	Scheme Amount	Actual Expenditure
Circle Scheme	148.24	143.099
Town Scheme	160.72	151.73
New Town Scheme	123.91	55.81
New Town Scheme	57.18	123.77
New city (3 cities)	373.57	82.19
Total	863.62	556.599

Source: Kerala State Electricity Board Ltd, 2015-16

2.6.3 Restructured Accelerated Power Development & Reform Programme (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 Government of India 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 December 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 percent grant is provided under R-APDRP Part-A projects while a maximum of 50 percent grant is being provided for Part B projects after fulfilling certain conditions.

Sanction for implementation of R-APDRP scheme during 11th 5-Year Plan with revised terms & conditions is conveyed by Government of India. The project focuses on actual demonstrable performance in terms of sustained loss reduction. The scheme includes collection of accurate base line data and adoption of IT in the areas of energy accounting. The scheme proposes to cover urban areas; towns and cities with population more than 30000. Forty three towns in Kerala state are eligible for implementation of the scheme.

Accelerated Power Development Programme (APDP) introduced in 2000-01was aimed at improving the financial performance of distribution utilities by extending additional central plan assistance for system improvement and reduction of distribution loses. After 2002 the APDP scheme was rechristened as APDRP with urban focus & introduction of reform element. APDRP scheme targeted reducing AT&C losses by 15 percent. The scheme covered incentive mechanism to incentivize utilities achieving cash loss reduction. This programme could not achieve the desired results in an effective manner. Places included under R-APDRP scheme in the city are Kunnamangalam, Koduvally, Beypore, Feroke, Ramanattukara and Kozhikode city.

The R-APDRP programme is sponsored by Government of India and funded through Power Finance Corporation (PFC). The progress achieved in the implementation of the above project in KSEB is summarized as follows:

2.7 MAJOR PROJECTS IN THE PIPELINE

2.7.1 Solar Park

As per the renewable purchase obligation notified by Regulatory Commission, the solar power purchase obligation for distribution licensees is 0.25 per cent of the total energy consumption for the year 2010-11 which will increase every year to reach 3 per cent by 2022. KSEBL proposes to implement solar power plants at vacant lands available at the sites of existing substations, powerhouses and rooftops of Vydyuthi Bhavanam and also in various government buildings.

The KSEBL has executed Memorandum of Understanding with Solar Energy Corporation of India (SECI) to develop different types of Solar Power Projects within / outside the State of Kerala. The proposal for setting up of 200 MW Solar Park at Kasargode District had been approved in-principle by Ministry of New & Renewable Energy (MNRE) in 2015. Government of Kerala has accorded sanction for the incorporation of the Joint Venture Company namely Solar Power Park Developer (SPPD) between Solar Energy Corporation of India and KSEBL for the implementation of the project in Kerala.

2.7.2 Integrated Power Development Scheme (IPDS)

Integrated Power Development Scheme (IPDS) was launched by Ministry of Power, Government of India for improving the distribution infrastructure of urban areas. The scheme include construction of 33kV substations, construction of 11kV overhead lines and underground cables, construction of LT lines, installation of transformers, and replacement of electro mechanical meters with electronic meters. An amount of 592.07 crore has been sanctioned for the scheme. Out of this 32.82 crore has been received by KSEB as central share.

2.7.3 Bachat Lamp Yojana (BLY)

KSEB has decided to implement the CFL- CDM Scheme Bachat Lamp Yojana (BLY) in the entire State as part of the demand side management. This scheme is formulated such that high quality CFL will be provided to all the domestic consumers in the project area in exchange for a working incandescent bulb. The difference in returns is proposed to be adjusted through Carbon Credit that may be obtained through the Certified Emission Reduction from United Nations Framework Convention on Climatic Change (INFCCC).

2.7.4 Deen Dayal Upadhyay Gram Jyoti Yojana (DDUGJY)

This is another program launched by Ministry of Power for reducing AT&C loss, providing electricity to all households and for ensuring 24x7 power supply. Government of India has sanctioned an amount of 485.37 Crore on January 5, 2016 for implementing DDUGJY in the 14 districts of Kerala. As per the scheme, 1,61,199 rural households are proposed to be electrified. Among these, 41,884 numbers belong to BPL category. Work include construction of 33kV Substations & 33kV lines, 11kV lines & LT lines, installation of distribution transformers, replacement of energy meters and effecting BPL service connections.

The erstwhile Rajiv Gandhi Grameen Vidyutikaran Yojana (RGGVY) scheme for village electrification and providing electricity distribution infrastructure in the rural areas has been subsumed in the DDUGJY scheme

2.7.5 Rural Electrification - Rajiv Gandhi Grameen Vidhyutikaran Yojana (RGGVY)

Government of India launched RGGVY scheme during 10^{th} 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 12^{th} & 13^{th} plan RGGVY has been subsumed in the newly launched DDUGJY scheme in 2014.

Under the Rajiv Gandhi Grameen Vidyuthikaran Yojana (RGGVY) sanction has been obtained to implement the scheme in 7 districts of Kerala, namely, Kasaragod, Kannur, Kozhikode, Wayanad, Malappuram, Palakkad and Idukki with an amount or

Rs. 221.75 crores on 2005. A quadripartite agreement has been executed among Government of Kerala, KSEB, REC and NIPC Electric Supply Company Ltd (NESCL) to entrust implementation of the scheme in the 6 northern districts of Kasaragod, Kannur, Kozhikode, Wayanad, Malappuram and Palakkad with NES. Government of India launched RGGVY scheme for enhancing access to electricity, particularly for rural households which facilitates creation of productive employment opportunities including small and medium industries, khadi and village industries, cold chains, health care, and education and information technology. RGGVY was started in April 2005 by merging all on- going schemes at that time aimed at providing access to electricity to rural households. The schemes merged to launch RGGVY were given below:

- Minimum Needs Program : 1974-79
- Kutir Jyoti Scheme Initiation : 1988-89
- Pradhan Mantri Gramodaya Yojana (PMGY): 2001-02
- Accelerated Rural Electrification Programme (AREP): 2003-04
- Accelerated Electrification of One lakh villages and One Crore Households: 2004-05

2.8 Conclusion

The analysis of physical performance gives light on the fact that the total installed capacity of electric power has been increased over the study period from 2004-05 to 2014-15. The generation capacity increased by 0.12 percentage while the High Tension (HT) distribution lines and numbers of distribution transforms increased by 0.21 percentage and 0.13 percentage respectively. Also the efficiency has been improved, which is evident from the fact that T & D loss has been declined from 26.22 percentage to 14.32 percentage over this period. As a result of this, the KSEB could save electric energy by 2997.16 MU. Among different categories of consumers, domestic consumers are the major category. The requirement of electric energy (demand) has been increasing while the generation capacities have not much increased. This gap between requirement and generation is filled by purchasing

electricity from external sources. The financial performance is not showing a good sign during the study period. The long term financial ratio, ‘current asset turnover ratio’ is the only measure showing an improvement over the period.

3.1 INTRODUCTION

Electricity pricing varies widely from country to country and may vary significantly from locality to locality within a particular country. There are many reasons that account for these differences in price. The price of power generation depends largely on the type and market price of the fuel used, government subsidies, government and industry regulation and local weather patterns. The actual electricity rate (cost per unit of electricity) that a customer pays can be dependent on total usage, particularly for small customers (e.g. residential users).

Power in India is generated, transmitted and distributed mainly in the public sector. The State Electricity Boards are public enterprises constituting that part of the economy through which the State owns the means of production and participates directly in the production of the social product. The State Electricity Boards are vertically integrated, performing all the basic functions of generation, transmission and distribution of power supply to ultimate consumers. There has been phenomenal growth of power sector in the post-independence period. This growth has largely been at the hands of State Electricity Boards in accordance with the Electricity Act, 1948

The nature and characteristics of public utilities have inevitable implications for pricing from the fiscal and welfare view-points, which are often in conflict with one another. Public Utilities are designated by some scholars as business affected with a public interest (Garfield, Wallace 1964). These are distinguished from the other public enterprises because Public utilities sell their goods or services in a monopolistic situation and, therefore, the issues relating to public tariffs charged by such utilities as 'fair price' becomes more complicated as the so called 'fair price' cannot be determined in a free market. Further, in developing countries public enterprises are sometimes characterised by inefficient management, low utilisation of capacity, excessive bureaucratisation, delays in decision processes and inflation of operational cost because of overstaffing of workers and white collar salaried employees and managers. Hence prices determined on the basis of cost plus or average cost pricing in their case fail to reflect 'fair' prices. It is because of these

factors that the pricing of public enterprises becomes a highly controversial issue (Bhalla 1964).

The theory and practice of pricing in public enterprises has been attempted with special reference to electric power utilities. The first part deals with theoretical issues in public enterprise pricing. The second part reviews the pricing of power utilities in developed and developing countries including the thinking of Indian planners and economists on this issue.

3.2 THEORY OF PUBLIC ENTERPRISE PRICING

In a free market economy, the price system as a method of economic organisation performs various functions. In the first place, it rations the supplies of goods among consumers; this rationing is governed by the willingness of consumers to pay. Further, given perfect competition and provided the distribution of income is acceptable, it is a socially efficient process (Consumers' equilibrium). In the advanced capitalist countries, public enterprises are supposed to supply certain commodities at a reasonable price.

The pricing policy is used as an instrument to make allocation of resources as efficient as possible. The price paid by a consumer indicates his willingness to pay. Price is made to reflect resource embodiment in a given commodity production. However, prices do more than simply allocate costs to those who cause them. Price has a basic economic function. It provides signals and incentives to which buyers do in fact respond. Therefore, the price is used to signal the consumer the resource cost of supplying a particular commodity. This is essential for the efficient allocation of resources. The whole range of theory of public pricing has been evolved to ensure the optimal allocation of resources and the maximisation of social welfare. Secondly, prices direct the allocation of production between commodities through the market mechanism according to the criterion of maximum profit, which, on the same assumption, corresponds to social usefulness. Thirdly, the market allocates the different factors of production among their various uses, according to the criterion of maximizing their incomes and in accordance with the consumers' choice/preferences (producers' equilibrium). It thus governs the relative quantities of specific types of labour and capital equipment made available. Further, it also distributes income

among the factors of production and therefore among individual economic functionaries. Finally, the price mechanism is supposed to bring about equilibrium of aggregate money demand with a money supply (monetary equilibrium). Thus price mechanism is expected to solve all the economic problems of scarce means between alternative ends. An ideal price system is one which allocates inputs, produces outputs and distributes goods amongst consumers in such a way that no redistribution can improve· the social welfare, not only at a point of time but also over a period of time (Baumol 1978).

Most of the public enterprises operate in imperfect market conditions. Many of them are natural monopolies. Therefore, they have some degree of control over the course of events and can control their price and output. In the imperfect market conditions, pricing can be used as a policy instrument. There is no doubt that the role of prices in a mixed economy is comparatively restricted. It is more so in a fully planned economy, where the allocation of resources is largely decided by the planners. Nevertheless, prices play an important role in securing efficiency in the use of resources in the process of development.

In the developing countries like India where the public sector dominates the strategic sectors of the economy the pricing policies of the public enterprises have a pervasive influence on the growth and development of the economy and on the welfare of a broad cross-section of consumers. Their pricing policies should not only lead to an efficient allocation of resources but also to increase their production potential as also to improve their resource base. The impact of the public sector's pricing policies on the economy as a whole is of much wider significance than its share in production because of a number of backward and forward linkages. The price and investment decisions of an enterprise have a bearing on and stimulate economic activity in the related enterprises. Pricing policies in the current Five Year Plan have been expected to play a crucial role in increasing the surpluses of public sector undertakings and the fulfilment of the targets for internal resource invested in these enterprises. Pricing and Investment policies of these enterprises are also expected to ensure high growth with stability and social justice, which are the stated objectives of Indian planning.

3.2.1 Electricity Pricing: Power Utilities' Experience

Electricity pricing has been the subject of much study practically since the inception of the industry. As a result, the principles and practices of pricing evolved for this industry have been adopted in the pricing of most other public utility services, in varying degree depending upon their respective characteristics and market patterns.

3.2.1.1 Nature and Characteristics of Electric Utilities

Apart from being a natural monopoly, the electricity supply industry has specific economic characteristics of its own, both on the supply and demand side, which have implications for pricing in electricity undertakings. Power utilities have high capital output ratio mainly due to the fact that they provide services which are predominantly the product of capital equipment and serve a predominantly retail market made up of numerous small customers. The total fixed costs in power utilities are relatively greater but are largely independent of the volume of service provided. This characteristic permits electric utilities to achieve decreasing average unit costs as total plant capacity becomes more fully utilised. Other characteristics on the supply side are that electricity system has different types of generating capacity which work as part of an integrated system. The costs of supply vary by voltage and by time of supply. There are also uncertainties on the supply side such as variable. Generation in hydro plants depending upon water inflows, unpredictable break downs (known as 'forced outages') mainly of thermal plants and so on. Apart from this uncertainty of supply, a major economic characteristic of electricity is that it cannot be stored or produced in anticipation of demand.

On the demand side, there are some important features to be noted. First, customer demands for service must be supplied instantaneously. Second, the pattern of hourly, daily, seasonal, or annual use of facilities, called the load curve, is characterised by considerable variation taking the form of peaks and troughs. This characteristic of demand variation by time of day, season, etc. combined with the non storability on the supply side force electric utilities to invest in sufficient plant capacity to serve the peak or maximum annual demand, and must also provide reserve capacity to guarantee continuous service in the event of forced outages. As a result

electric utilities have periodically substantial amounts of unused capacity. These factors have a special bearing on the electricity pricing.

3.2.1.2 Technicalities of Electricity Pricing

An electricity supply system is a complex network of different kinds of generating capacity, a transmission network to transmit electricity from the generating centres to the load centres, and a distribution network which provides supply to the ultimate points of consumption. There are many technical problems in the study of electricity pricing. These are: (a) complexity due to the mass of technical details, which must be considered in designing/administering rate schedules; (b) 'Ignorance' of rate-makers of demand and supply functions; and (c) the need to consider numerous conflicting standards of fairness and functional efficiency (James 1964).

The costs of electric supply have an essentially dual nature; some are related to the plant or capacity while others are related to energy output. These costs are affected by some basic technicalities of electric supply. These include peak demand, the load factor and the diversity factor. The maximum load or the maximum power requirement upon a system is called the peak load or peak demand. Because electricity cannot be stored, the annual system peak load dictates the size of plant required by an electric utility, except to the extent that inter connections with other utilities may be depended upon for assistance in meeting peak demands. Although the size of plant is generally determined by the peak annual demand on the utility system, it is also important to note that pricing policy is influential in determining the magnitude of the annual peak. Thus an interrelationship exists wherein: (a) peak demand determines plant size and, therefore, to a considerable extent, the total of plant-related costs whose recovery from sales revenues is an important consideration in pricing policy; while (b) at the same time, pricing policy directly influences the size of the annual peak, particularly where industrial customers are concerned. This suggests that public utility pricing policy involves, in effect the simultaneous solution of questions relating both to plant size and to price level for different classes of service.

3.2.1.3 Approaches to Electricity Pricing

Pricing policies in the electricity industry, even in the developed countries, have historically been dominated by professional utility managers and engineers. The traditional approach is basically an accounting approach. This approach is based on the calculation of historical costs from the financial accounts of the utility. Obviously this involves a comprehensive stock-taking of all assets, old and new. Using this stocktaking, certain 'capacity related' costs are derived and various 'energy related' costs are evaluated. Maintenance costs are allocated to the former or the latter as considered necessary. Purely 'customer related' costs are allocated as equitably as possible among customers on the basis of who has imposed costs on the utility. A tariff structure is formulated for each customer class, which includes kW charges as well as kWh charges.

Based on these, electric utilities prepare their schedules of rates and the rules and regulations under which different types of service are available. The principal types of rate schedules used in the past or currently by electric utilities included (a) flat rates; (b) two-part rates; (c) block rates; (d) off-peak rates (e) current limiters and (f) bulk supply rates.

The basic principle underlying the above approach which still governs rate-making all over the world is that accounting or historical pricing. The pricing a very crucial parameter, simply provided too cheaply, this will over stimulate demand and put enormous burden to supply. So the pricing policy must be such that it is a signal to the consumer, either that electricity is cheap or that it is expensive.

In electricity production, the product is demanded in a cyclical fashion and is, to a large extent, unstorable. Although the same machines may be used to produce electricity during the day or at night, day-time and night-time supply of electricity is best thought of as separate products with joint or common costs. When two products with different costs of production are priced at the same level, there is a tendency to consume too little of the over-priced product and too much of the underpriced product; consumers do not receive the correct signals. They make decisions based on a price of peak electricity that is too low. On the contrary, the costs of expanding the electricity system to meet peak demands have been greater than the price charged.

Night-time electricity is relatively inexpensive to price but the uniform price does not give the correct signal.

In being inadequate as a signalling device, the accounting approach ignores the incentive effects of tariffs. Tariffs give incentives to consumers by signalling them when electricity is cheap, e.g. during off-peak hours, and when it is expensive, e.g. during peak hours. Incentive effects are quite relevant in regulating electricity demand in accordance with the requirements of the undertaking, which incurs different costs during different periods of the daily cycle. The average accounting costs, being unrelated to the incremental cost of supply in different periods, are thus inadequate in this respect.

3.3 FINANCIAL PERFORMANCE AND PRICING POLICY

The financial performance is very much affected by the pricing policy an attempt is made to briefly analyse the evolution of price polices overtime focusing the financial position of the board. Before independence, electricity undertakings were governed by the Indian Electricity Act of 1910. The Act of 1910 related to the generation transmission, supply and use of energy, it was primarily regulatory in character and was not development oriented. After independence the policy makers recognised the crucial importance of electricity for the development of the economy and gave a high priority to its development. In order to develop this sector in a planned manner a comprehensive Act, known as Electricity Act, 1948 was enacted soon after Independence. This Act provided for the establishment of State Electricity Boards as autonomous corporate bodies in the public sector to develop power at the state level and the creation of the Central Electricity Authority to formulate overall policy and coordinate power development schemes at the national level. This Act also provided broad guidelines for the determination of electricity tariffs.

The revenue objectives of the State Electricity Boards are stated in section 59 of the Electricity Act, 1948. Initially the concept was that the Boards should manage their operations in such a way as not to incur losses. The Section has been amended twice to make its provisions more specific and obligatory. The first amendment in 1978 made it mandatory for a State Electricity Board to earn a positive return. This

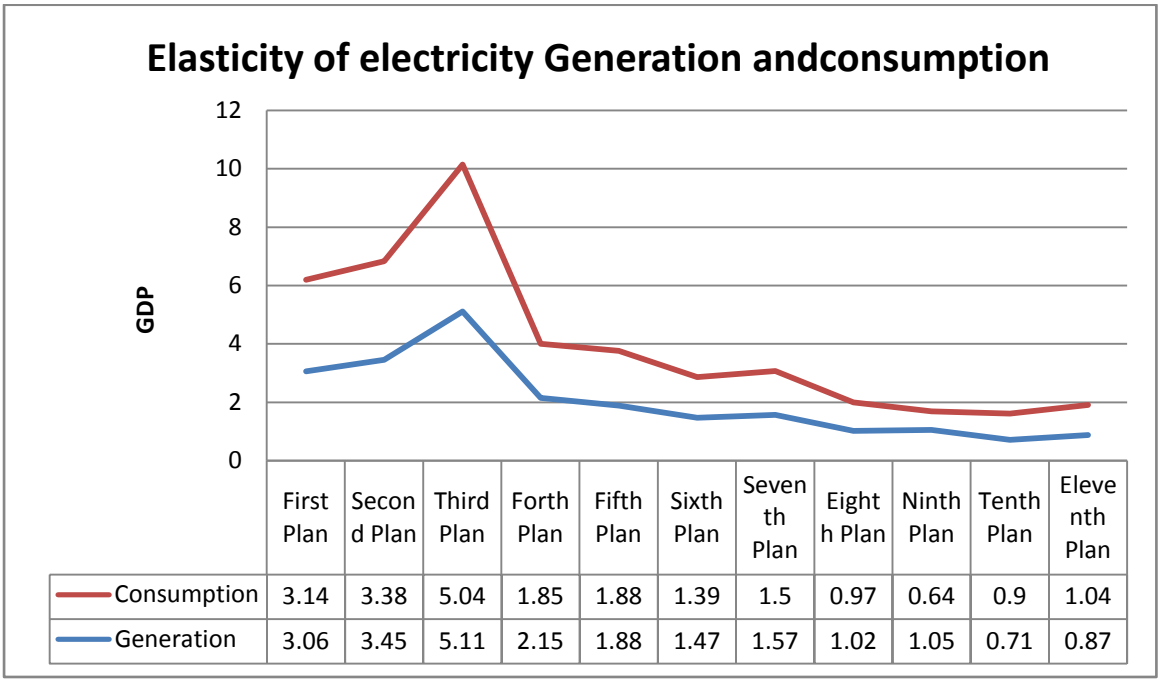
was done because the Government of India was not satisfied with the financial performance of the State Electricity Boards as most of them were operating at a loss and the losses had been on the increase from year to year. The Central Government, therefore, wanted the State Electricity Boards to achieve a reasonable rate of return which would generate surplus after taking into account all operating expenses, depreciation, interest and taxes to finance at least a part of their investments. Despite this amendment in the Electricity (Supply) Act in 1978, there was no sign of any noticeable improvement in their performance.

3.3.1 Financial Position of State Electricity Boards

The pricing policy and financial position of electricity undertakings were examined by a Working Group constituted by the Planning Commission in 1962. The Working Group found that the average rate of return on capital employed in all the electricity boards in 1957-58 was 3.9 percent. The comparison of cost of service to various consumer classes and average revenue of the electricity boards showed that whereas large industries and agriculture were being highly subsidised, domestic consumption and public lighting were being charged at par and the commercial and small industrial consumers were being charged at more than the cost of services leading to great deal of cross subsidisation. It recommended 32 per cent increase in the price charged by the Boards so that they could earn a return of 12 per cent on their capital investment (Govt. of India)

Figure 3.1

Elasticity of electricity Generation and consumption w.r.t. GDP



	First Plan	Second Plan	Third Plan	Forth Plan	Fifth Plan	Sixth Plan	Seventh Plan	Eighth Plan	Ninth Plan	Tenth Plan	Eleventh Plan
Consumption	3.14	3.38	5.04	1.85	1.88	1.39	1.5	0.97	0.64	0.9	1.04
Generation	3.06	3.45	5.11	2.15	1.88	1.47	1.57	1.02	1.05	0.71	0.87

Source: The planning commission. Govt of India 2014-15

Figure 3.1 gives the Plan-wise elasticity of electricity generation and consumption with respect to GDP from the First Plan to the Eleventh Plan. The elasticity of electricity generation and consumption vis-à-vis GDP has declined over time after an increase till the Third Plan. The elasticity of electricity generation and consumption for the Eleventh Plan (2007-12) was 0.87 and 1.04 respectively.

Table: 3.1 Total cost of supply category wise (in Crore)

Year	Domestic	Commercial	Industrial LT	HT & EHT	Agriculture	Public Lighting	Licensees	Export	Railway Traction	Total
2003-04	5596.2	1834.7	1048.7	3120.1	295.2	231.7	262.8	0	64.8	12454
2004-05	5555.9	1714.4	1042.9	3681.4	266.4	243.8	281.4	0	57.5	12844
2005-06	5707.0	1335.8	1067.8	3524.7	232.0	254.6	362.6	775.9	70.7	13331
2006-07	6077.1	1451.5	1089.3	3592.6	256.8	266.9	391.0	1220.6	83.7	14430
2007-08	6301.8	1550.2	1107.3	3531.3	259.1	280.2	400.7	1515.6	123.5	15070
2008-09	7044.1	1783.2	1205.1	3546.5	267.6	350.2	377.7	550.6	168.2	15293
2009-10	7930.7	2166.9	1285.6	4130.1	310.8	366.8	499.3	93.4	288.7	17072
2010-11	8125.7	3318.9	1245.0	3187.1	282.6	313.9	528.9	154.3	185.5	17342
2011-12	9018.7	2505.6	1284.1	4482.8	335.2	344.7	553.0	234.8	179.9	18939
2012-13	9813.4	2625.8	1300.0	4609.5	361.8	369.7	590.4	2.0	204.7	19877
2013-14	9515.3	2426.1	1193.5	4394.0	336.9	347.2	569.0	1540.7	217.8	20541
2014-15	10505.2	3130.5	1159.1	4223.2	316.1	418.7	629.9	1634.4	211.0	21575
2015-16	11661.4	3209.1	1293.2	4815.9	327.3	429.5	677.3	63.6	250.0	22727
CAGR	**6.77**	**6.88**	**1.71**	**2.94**	**2.53**	**5.02**	**7.83**	**24.8**	**13.3**	**5.34**

Source: Power System Statistics 2016

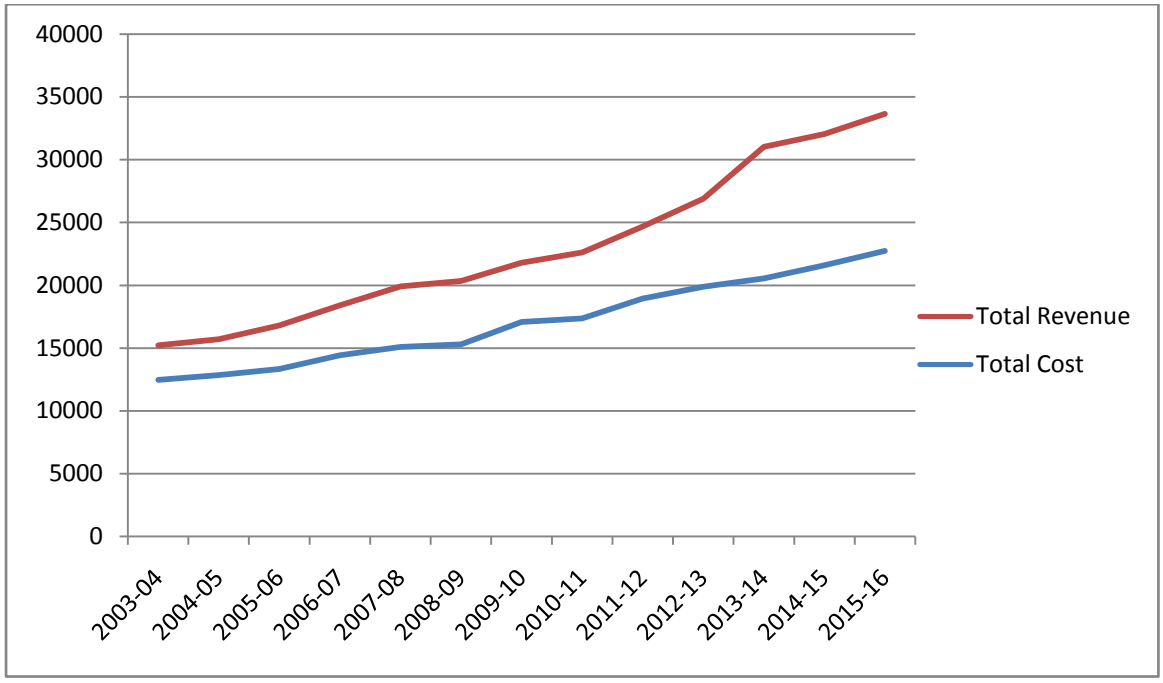
Total: 3.2 Total Revenue (In Crore)

Year	Domestic	Commercial	Industrial LT	HT & EHT	Agriculture	Public Lighting	Licensees	Export	Railway Traction	Total
2003-04	710.0	578.5	305.4	1045.7	19.6	28.1	57.9	0	16.8	2762
2004-05	690.8	633.7	324.7	1081.5	18.4	33.3	57.5	0	16.0	2855.9
2005-06	730.0	724.3	362.3	1128.4	18.9	38.1	80.8	365.7	19.5	3468
2006-07	822.0	823.2	387.3	1214.5	22.5	42.9	92.6	533.3	24.1	3962.4
2007-08	1090.2	921.1	408.2	1259.7	24.4	47.4	101.9	931.9	39.0	4823.8
2008-09	1293.7	1116.6	466.8	1432.7	30.3	58.7	144.3	438.4	67.5	5049
2009-10	1245.2	1259.4	453.8	1007.3	28.0	58.4	144.8	452.9	65.5	4715.3
2010-11	1423.9	1410.9	460.6	1512.8	26.5	56.1	163.2	139.8	64.5	5258.3
2011-12	1667.8	1592.9	461.4	1600.7	30.8	63.8	183.5	66.6	61.5	5729
2012-13	1954.6	1855.7	587.3	2146.1	47.0	94.6	255.0	0.7	82.3	7023.3
2013-14	3206.7	2102.6	682.2	2576.3	56.9	118.7	293.2	1336.5	107.7	10481
2014-15	3611.5	2224.6	721.3	2643.4	61.7	140.6	320.7	634.3	115.3	10473
2015-16	3896.5	2548.5	777.1	2931.6	68.8	162.6	361.3	43.7	125.5	10473
CAGR	**16.6**	**13.6**	**7.76**	**9.3**	**11.9**	**14.8**	**17.3**	**20.4**	**20.1**	**12.4**

Source: Power System Statistics 2016

Category wise total cost of supply and total revenue from electric energy distribution are given in table 3.1 and table 3.2. The cost of supply of electricity to all categories of consumers except export category has been increased during the period from 2004-05 to 2014-15. The highest growth in the cost of supply during the period accounted to the category of 'Export' (24.8%) which is followed by the categories, Railway Traction (13.3%) Licensees (7.83%), Commercial (6.88 %), Domestic (6.77%) etc... At the same time, growth in total revenue during the same period outrange of the growth in supply cost. When the growth in cost of supply is 5.34 percentage, that in revenue is 12.4 percent during the same period.

Figure 3.2 Total cost and Revenue of KSEB



Source: Power System Statistics 2015-16

3.3.2 Pricing Policy of the State Electricity Boards

Tariff making is of vital importance not only to the electric supply undertaking, but to the state as a whole. The revenue derived from tariffs is the mainspring of the healthy growth of the undertaking. At the same time a rational formulation and proper administration of an adequate but realistic tariff schedule is necessary to safeguard the interests of the public and to stimulate heal they economic development of the state.

As stated earlier the position of the State Electricity Boards in India is unique. While a Board has the social responsibilities of a public utility to serve all who apply for service, it is also to be governed by the economic compulsions of a commercial enterprise. Although enjoying monopoly position in its operations, the dual role thus thrown upon the State Electricity Board often makes its task unenviable.

In this section, it is proposed to examine the tariff structure of the Kerala State Electricity Boards as 'they have evolved over time. In order to bring out the rationality behind the present pricing policy as reflected in the tariff structure, the average revenue per unit of energy supplied to each consumer class has been computed and compared to the cost of supplying power. This will help to bring out the extent to which energy sale to each consumer class involves profit earning or subsidisation.

The State Electricity Boards have regarded electricity pricing as a simple matter of accounting whereby price adjustments are made in keeping with changes in accounting cost. Most of the State Electricity Boards follow the average cost based pricing principle. The actual tariff is worked out by the application of certain rules of the thumb keeping an eye on the average cost of supply. Being monopolies as well as public utilities, the boards give due recognition and weight to the principles of (a) what the traffic can bear and (b) cross subsidisation. Under section 78-A of Electricity Act, 1948, the boards in the discharge of their functions, are to be guided by such directions on questions of policy as may be given to them by the state government. As a result, the state objectives dispersal of industrial units, of rapid industrialisation, development of small scale industries, expansion of irrigation facilities for stepping up agricultural production, meeting of urban and household demand etc. have generally gained precedence in the past over rigid economic/principles of pricing policy. The Boards were expected to fix rates at levels which would not impede economic growth in industrial and agricultural sectors and shall also meet other socio-economic objectives pursued by the State.

The consumers of electricity are grouped into various categories on the basis of the purpose of use or the nature of demand. These categories have been changed from time to time keeping in view the load characteristics purpose of energy use etc. The major categories in KSEB: (i) Domestic (ii) Commercial, (iii) Industrial (iv) Public

lighting (v) Agricultural (vi) Public Water Works (vii) Traction and Railways (viii) Bulk Supply to Distributing Licensees and (ix) Miscellaneous supply to mixed loads.

The fixation of tariff rates for different classes of consumers is not a mere arithmetical exercise of arriving at the overall cost per unit of power and fixing the rates for each class at a stage higher than the overall cost to the Board. The cost of supplying power depends upon several factors. These include (i) quantity of energy supplied (ii) maximum demand (iii) load factor (iv) diversity factor (v) location (vi) time of load incidence (vii) seasonal variations of load and (viii) power factor

3.3.3 Electrification Initiatives

Various schemes and programmes would help to take the next level several initiatives such as total rural electrification and energy efficiency campaign with a major push to micro hydro electric projects. A cluster based programme would be initiated to tap the micro hydro electric projects whose mandate would be to tap energy using optimum resources from run of the river flows in forest and other vulnerable localities. An atlas of 996 potential micro hydro sites in the State has been drawn up as part of the total electrification drive. Electrification of houses of the marginalized sections has been identified as one of the thrust areas. About 5 lakh non electrified houses have been identified as part of the total electrification programme in TESM local Governments.

The total Electrification Programme comes as a bonanza to a large number of tribes who live in remote forest areas where drawing power lines is almost impossible. The highlight of the total electrification scheme is that power lines were drawn for more than 10 to 15 km so as to provide power supply to tribal areas. The State Government is trying to provide power to each house hold in the State, the central electricity act brought by the Central Government is trying to bifurcate Electricity Boards into different companies. This is attempting to privatize the power sector. But the State Government is opposed to the bifurcation of the board in to different companies. It wanted the Kerala State Electricity Board to remain as one company. The State Government will oppose the move to privatize the electricity board.

Table 3.3

Electricity Pricing Strategy - Slab wise Rate/unit

Telescoping billing		Non Telescoping billing	
Units	Rate / Unit	Units	Rate / Units
0-50	2.80	0-300	5.00
51-100	3.20	0-350	5.70
101-150	4.20	0-400	6.10
151-200	5.80	0-500	6.70
201-250	7.00	Above 500	7.50

Source: Tariff Revision KSERC, 2017

3.3.4 Tariff and Regulation

The Kerala State Electricity Regulatory Commission (KSERC) has accorded sanction for restructuring power consumption of HT, EHT consumers and accordingly, KSEB issued orders that all HT and EHT consumers of KSE Board and other licensees should restrict their energy consumption of 75 percent of the base average consumption. Again based on Board's Petition, KSERC accorded sanction to restrict the consumption of LT consumers and Board had implemented the same with effect from 15.10.2008. Average monthly quota for LT domestic consumers has been fixed as 200 units and for all other categories (except LTVID) 80 percent of average monthly consumption.

Power tariff is expected to go will go up by an average of 24 per cent for domestic consumers with effect from August 2016 in Kerala. The lowest category of domestic consumers, using less than 40 units of energy a month, has been exempted from any tariff hike by the Kerala State Electricity Regulatory Commission, which issued its tariff order for 2014-15 on Thursday. The commission, however, restricted this heavily subsidised rate to the BPL families. Others in this category will have to pay at the rate of Rs.2.80 a unit. The slab system, now being followed for billing domestic consumers, will continue with some changes up to the level of a monthly consumption of 250 units. The new rate for each category is given in the table. The

highest rate for domestic consumers is Rs.7.50 a unit and it will be applicable to those consuming more than 500 units a month.

Up to a monthly consumption of 250 units, 'telescopic billing' will be followed for each domestic consumer. This means that, for the first 50 units the rate will be less, for the second 50 units it will be more, for the third 50 units still more and so on. After 250 units, the billing will be 'non-telescopic,' which means the slab rate will be applicable for the entire electricity consumed. With these revisions, the average revenue realisation on a unit of electricity supplied to domestic consumers will be Rs.3.75 for the Kerala State Electricity Board (KSEB). As a group, the domestic consumers are cross-subsidised to the extent of 29 per cent of the cost involved in power supply. For industrial consumers, the tariffs will go up by around 10 per cent on an average. As a group, they are already paying rates exceeding the average cost of supply. The revised rates exceed the average cost of supply by 15 to 20 per cent. The commission has made only nominal increases in tariff to various sections of commercial consumers, who are actually paying rates far above the average cost of power supply. Even so, as a group, their revised tariff is nearly 80 per cent more than the cost of supply. For agricultural consumers, who are getting power at heavily subsidised rates, the tariffs are being increased by nearly 30 per cent.

3.3.5 Domestic Consumers

The domestic consumers play a major role in the Kerala Power System. As per the accounts of the Board, KSEB has about 75.00 lakhs domestic consumers occupying 80 percent of the total number of consumers in the system. The quantum of energy consumed by them was about 5938MU during 2008-09, which accounted 47.80 percent of the total sale now that increase into 49.5 percent in 2015-16. The total revenue earned from the sale of energy to domestic category during 2008-09 was Rs 1070 crores, which was only 28 percent of the total revenue (Tariff rationalisation 2009-10).

The average power consumption in the state has almost touched 64 million units. This may rise to 80 or 82 million units in the peak of summer in March. It is expected to settle somewhere between 75 to 78 million units throughout the summer

(KSEBL). The increase in consumption should be seen in the background of the fact that 2016 witnessed the lowest inflow of water to hydel dams. Compared to water level in dams during the previous year, there is a shortage of water worth for generation of 800MU

At present, the board imports around 57 million units of power to meet the daily demand. Of this 29MU, the state get as central share and the rest is brought to the state through long, medium and short-term power purchases. State used to purchase 700 to 800 MW of power from outside annually to meet the shortage. It's true that the power scenario across the country is bad at present. Kerala, being a state mostly dependent on power generated outside the state, will obviously suffer in the event of even a mild turmoil in the national power scene.

The prevailing tariff rates to the domestic consumers, especially for the lower consuming slabs are far below the average cost of supply. At present, the benefits of the subsidized tariff at the lower consuming slabs are extended to high consuming domestic consumers belong to upper strata in the society. The Electricity Act- 2003 and the Tariff Policy notified by the Central government is for reducing the subsidy allowed to the domestic consumers in a phased manner. But, considering the socio-economic condition in the State, the subsidized tariff allowed to the weaker and downtrodden segments of the domestic consumers need to be continued for few more years. But, the benefit of the subsidized tariff allowed at present need not be continued to the high consuming groups consuming more than 200 units per month. KSEB propose to dispense with the present telescopic tariff system for domestic consumers with monthly consumption above 200 units. But, to avoid tariff shock due to withdrawal of telescopic billing system for this class of consumers, about 15 percent reduction from the existing slab rate is proposed. Due to this, the subsidized tariff allowed to the low-income groups can be compensated to some extent through the cross subsidy from the high consuming groups of domestic category.

As per prevailing tariff structure, the domestic category is divided into eight different consumption slabs based on monthly consumption and the tariff for each slab is as detailed in table 3.4.

Table: 3.4

Monthly consumption slab (in units)

Monthly consumption slab (in units)	Rate (Rs/kWh)
0-40	1.15
41-80	1.90
81-120	2.40
121-150	3.00
151-200	3.65
201-300	4.30
301-500	5.30
Above 500	5.45

Source: Tariff Revision KSERC, 2017

The telescopic billing system now existing for domestic category, with which benefit of low tariff of the lower consumption slabs is extended to entire domestic consumers, irrespective of the quantum of consumption. It may also be noted that, the prevailing tariff of the lower consumption slabs are much less than the average cost of supply. As per the accounts of the Board, the average cost of supply for 2007-08 is Rs 3.93 per unit whereas the tariff for monthly consumption upto 40 units is Rs 1.15 per unit only, i.e., just 29.26 percent of the average cost of supply.

This highly subsidized rate is allowed to the lower consumption slabs considering the socio-economic conditions prevailing in the State and inability of the downtrodden segments in the society to bear higher tariff. But it is not justifiable in extending benefits of such subsidized rates to higher consumption groups of consumers having modern electrical gadgets, which consume more energy for their luxury and comforts.

The estimate of the number of consumers, consumption and the revenue from the domestic category for the year 2008-09 is given table 3.5.

Table 3.5

Monthly consumption and consumers details

Monthly consumption slab(in units)	No of consumers			Consumption		
	(Nos)	Percentage of total (%)	Cumulative (%)	in Million Units (MU)	Percentage of total (%)	Cumulative (%)
0-40	2968752	39.5	39.5	893	13.5	13.5
41-80	2382517	31.7	71.2	1772	26.8	40.3
81-120	1052216	14.0	85.2	1356	20.5	60.8
121-150	518592	6.9	92.1	873	13.2	74.0
151-200	349486	4.7	96.8	787	11.9	85.9
201-300	184138	2.5	99.2	549	8.3	94.2
301-500	48853	0.7	99.9	245	3.7	97.9
Above 500	11274	0.2	100.0	139	2.1	100.0
Total	7515828	100.0		6613	100	

Source: Tariff Revision KSERC, 2017

It is clear that 60.8 percent of total electricity consumption fall under the monthy consumption slab of below 121 units in which 41-80 slab consumers use more electric energy of 26.8 MU. At the same time the monthly revenue from existing tariff of below 121 units slab is only 46.8 percent of total revenue that shown in table 3.6.

KSEBL earned 1261.2 crore as total revenue at existing tariff and the total consumption of energy was 6613 in 2017. The majority consumers consumed 1772 MU energy, it include in the slab 41-80 and KSEB earned250.9cr less consumption was occurred in the slab above 500 (139 MU) and earned 65.6 cr as revenue in 2017. At the present level of consumer preferences, the monthly consumption of a middle class family is about 151 to 200 units only. An indication of equipment wise monthly consumption of middle class family is given table 3.6.

Table 3.6

Monthly Electricity Consumption and Revenue

Monthly consumption slab (in units)	Energy consumption (MU)	Revenue at Existing Tariff			
		Total (Rs. Cr)	Percentage of total (%)	Cumulative percentage (%)	Average realization (Rs/kWh)
0-40	893	102.7	8.1	8.1	1.15
41-80	1772	250.9	19.9	28.0	1.42
81-120	1356	237.0	18.8	46.8	1.75
121-150	873	173.5	13.8	60.6	1.99
151-200	787	186.8	14.8	75.4	2.37
201-300	549	154.4	12.2	87.6	2.81
301-500	245	90.4	7.2	94.8	3.70
Above 500	139	65.6	5.2	100.0	4.72
Total	6613	1261.2	100.0		1.91

Source: Tariff Revision KSERC, 2017

From table 3.7, it can be seen that the monthly consumption of an middle class family is about 200 units only. Out of the total 75 lakhs of domestic consumers, 2.44 lakhs domestic consumers only have monthly consumption above 200 units (bi-monthly consumption above 400 units). So it is a matter to be reviewed whether the benefit of the subsidized tariff granted to the lower segments of domestic consumers to be extended to the high consumption groups in the domestic category also.

Hence, KSEB propose to limit the present telescopic system of billing for the domestic consumers with monthly consumption up to 200 units only. The details are given below. No tariff increase for monthly consumption up to 200 units per month (for the 1st five tariff slabs).

Table 3.7

Type of Load and Energy Consumption

Monthly Consumption - units	Type of Load	Power rating (W)	Quantity (Nos)	Avg. Number of working hours/day	Energy Consumption/day (units)	Energy consumption/month (Units)
50	Bulb	40	5	4.0	0.80	24.0
	Fan	60	1	10.0	0.60	18.0
	Fan	60	1	3.0	0.18	5.4
	Socket	450	1	0.2	0.09	2.6
	Total				1.67	50.0
150	Bulb	40	6	4.0	0.96	28.8
	Bulb	25	2	8.0	0.40	12.0
	Fan	60	2	8.0	0.96	28.8
	Fan	60	2	4.0	0.48	14.4
	TV	100	1	4.0	0.40	12.0
	Iron box	750	1	0.25	0.19	5.6
	Mixy	600	1	0.25	0.15	4.5
	Fridge				1.15	34.5
	Computer	150		2.0	0.30	9.0
	Total				4.69	150
200	Bulb	40	8	4.0	1.28	38.4
	Bulb	25	2	8.0	0.40	12.0
	Fan	60	3	10.0	1.80	54.0
	Fan	60	2	5.0	0.60	18.0
	TV	100	1	5.0	0.50	15.0
	Iron box	750	1	0.25	0.19	5.6
	Fridge				1.15	34.5
	Mixy	600	1	0.25	0.15	4.5
	Grinder	750	1	0.15	0.11	3.4
	Washing	325	1	0.50	0.16	4.9
	Computer	150	1	2.50	0.38	11.3
	Total				6.34	202

Source: Tariff Revision KSERC, 2017

Non-telescopic billing system is proposed for monthly consumption above 200 units, but with reduced tariff as detailed below.

(i) For monthly consumption 201 to 300 units- a flat rate of Rs 3.65/unit is proposed. i.e, the entire consumption of this block is proposed to bill at Rs 3.65 per unit (about 15% reduction over existing slab rate of Rs 4.30 per unit).

(ii) For 301 to 500 units – a flat rate of Rs 4.50 per unit is proposed. i.e, the entire consumption of the block is proposed to bill at the flat rate of Rs. 4.50 per unit (about 15% reduction over the existing slab rate of Rs 5.30 per unit).

(iii) Above 500 units per month- a flat rate of Rs 5.00 per unit is proposed. i.e, the entire consumption of the block is proposed to bill at the flat rate of Rs 5.00 per unit (about 8.30% reduction over the existing slab rate of Rs 5.30 per unit).

Table 3.8

Monthly consumption Slab (Units)

Slab (units)	Existing Tariff			Proposal			
	Existing Tariff (Rs/kWh)	Revenue at Existing tariff (Rs. Cr)	Remarks	Tariff rate (Rs/kWh)	Revenue at proposed tariff (Rs.Cr)	Additional income (Rs.Cr)	Remarks
0-40	1.15	102.66	Telescopic tariff system	1.15	102.66	0.00	No increase
41-80	1.90	250.94		1.90	250.94	0.00	
81-120	2.40	236.95		2.40	236.95	0.00	
121-150	3.00	173.49		3.00	173.49	0.00	
151-200	3.65	186.77		3.65	186.77	0.00	
201-300	4.30	154.36		3.65	200.33	45.97	Non-telescopic with reduction in
301-500	5.30	90.42		4.50	110.10	19.68	
Above 500	5.45	65.61		5.00	69.43	3.82	
Total		1261.21			1330.68	69.47	

Source: Tariff Revision KSERC, 2017

The likely increase in bill amount for domestic consumers with this proposal is given table 3.8

Table 3.9

Bi-monthly consumption Tariff

Bi-monthly consumption	Bill amount (Rs)		
	at existing tariff	Proposed tariff	% increase
100	130.0	130.0	0.0%
200	340.0	340.0	0.0%
300	616.0	616.0	0.0%
400	981.0	981.0	0.0%
500	1411.0	1825.0	29.3%
600	1841.0	2190.0	19.0%
700	2371.0	3150.0	32.9%
800	2901.0	3600.0	24.1%
900	3431.0	4050.0	18.0%
1000	3961.0	4500.0	13.6%
1100	4506.0	5500.0	22.1%
1200	5051.0	6000.0	18.8%

Source: Tariff Revision KSERC, 2017

It may be noted that, the increase in tariff for the domestic consumers with bi-monthly consumption above 400 units would be in the range of 13.6% to 32.9 percent only. As stated earlier, out of the total 75.16 lakhs domestic consumers, only 2.44 lakhs belongs to the upper strata, who are not concerned for energy conservation only be affected with the proposed revision. That is, about 72.72 lakhs (96.8% of the total domestic consumers) is not affected by the proposed tariff revision.

The main challenges faced by the energy sector in the State are i) Inadequate capacity addition over the years leading to massive in house demand supply gap ii) Hydel power dominated supply scenario iii) Negligible share of renewable energy in the energy mix iv) Gap between energy conservation potential and its realization v) Limited presence of Independent Power Producers (IPP) and Co-Generating Stations (CGS) and vi) Limited penetration of star rated products.

However on the positive side, the development of the power grid at the regional and national level has allowed States like Kerala to purchase a large proportion of its power from sources and producers outside the State. Thus in house capacity addition does not carry the same significance as before. The new challenge is to be able to find an adequate basket of sources, suitably distributed over time and hours of the day, with advance purchase agreements so that the net cost of purchased power is suitably optimised (Economic Review 2016).

Despite public enthusiasm for renewable energy and the keen interest of government in the matter, renewable energy capacity installation and generation has fallen below the anticipated levels. They need to overcome various constraints in the growth of renewable capacity as well as the need for a shift in emphasis in the development of renewable energy (Central Electricity Authority).

3.4 Conclusion

The Kerala State Electricity Board follow average cost based pricing principle by giving weights to the principles of tariff and subsidy. The cost of power supply depends on several factors like quantity of energy supply, maximum demand, load factor, diversity factor, location, time of load incidence, seasonal variations of load and power factor. The KSEB has revised its tariff structure from time to time to cover up the cost of electricity supply. But the financial ratio did not show any improvement over the period from 2004-05 to 2014-15.

4.1 Introduction

Kerala's electricity consumption is predominantly domestic, which accounts for half of the total consumption. Revenue of KSEB from Domestic consumers is only 36 per cent of the total revenue. The domestic category consumers showed a growth rate of 1.52 per cent from 89,87,947 in 2014-15 to 91,24,747 in 2015-16. Per capita consumption has increased by 3.86 per cent, that is, to 565 KWh in 2015-16 against 544kWh in 2014-15. During 2015-16, 19,325 MU of energy valued at Rs 10,44,601 lakh was sold (internally) showing an increase of 409 MU as compared to the previous year 1595 MU (table 2.8). Total consumption and per capita consumption of electricity in Kerala show a fluctuating pattern of growth. The state of Kerala is on the anvil of faster development to keep pace with the growth of national economy. Power is the most important infrastructure to engineer the developmental activities in the state in tune with the missions and objectives of the government in respect of social development and economic growth.

Kerala State Electricity Board (KSEB) is the deemed distribution licensee for supplying electricity to the whole consumers including Bulk Licensees in the State of Kerala. KSEB is the State transmission Utility and it is the Generator of Electricity entering into long term agreement with Central Generating Stations for purchasing electricity for supply in the state. KSEB is also procuring electricity from short-term markets for meeting the deficit of electricity requirements of the state. KSEB has been functioning under the provisions of the Electricity Act-2003 and also in accordance with the regulations and directions issued by the Kerala State Electricity Regulatory Commission (KSERC) under the Electricity Act-2003, National Electricity Policy and Tariff Policy from time to time. KSEB as the Government entity has been implementing the policy directives of the State and Central Government in the State of Kerala. As per the provisions of the Electricity Act-2003 and National Electricity Policy & Tariff policy notified by the Central Government, KSEB has to function on commercial principles.

The Board had been supplying electricity at lowest price in the country for several decades mainly because of the substantial contribution from hydel resources.

The major changes in the power supply mix brought about from the 1990's had resulted into a peculiar situation whereby the cost of power procurement and generation has increased phenomenally which could not be adequately compensated through tariff revisions. At present more than 64 percent of the energy requirement of the State is being met from thermal sources.

The Kerala State Electricity Board Ltd. continued to function as the state Transmission Utility and a distribution licensee as per section 14 of the Electricity Act, 2003. In addition to Kerala State Electricity Board Ltd, the following are the distribution licensees in the state.

i) Thrissur Corporation Electricity Department (TCED), Thrissur

ii) Kannan Devan Hills Plantations Company Private Limited(KDHPCL), Munnar

iii) Technopark, Thiruvananthapuram

iv) Cochin Special Economic Zone Authority (CSEZA), Kochi

v) KINESCO Power Utilities Private Ltd. (KPUPL), Kochi

vi) Rubber Park India Private Ltd. (RPIL), Ernakulam

vii) Cochin Port Trust (CPT), Willingdon, Kochi

viii) Military Engineering Service (MES)

ix) Pondicherry Electricity Department, Mahi

There are 9 Licensees procuring energy from KSEB at bulk tariff and supplying energy to the consumers within their licensed areas. Since KSEB is the supplier of electricity to these licensees, the entire risk associated with the procurement of electricity, periodical enhancement of rate of electricity by Central Generating Station (CGS) and Central Transmission Utility (CTU), shortage of power due to transmission congestion, volatility of the fuel prices, vagaries of monsoon etc. (Tariff Revision KSEB, 2013) is borne by KSEB.

The Thrissur Corporation Electricity Department (TCED) is one of the 9 electricity distribution licensees in the State of Kerala, under the Electricity Act 2003. The TCED has an operational history of 77 years, starting August 1937, when the

generation & distribution business of Cochin State Power & Light Corporation Ltd was purchased for Rs.5.8 Lakhs by the Thrissur Municipality (erckerala.org).

The Trichur Power House, which was supplying power to Trichur Municipality was taken over by the Government of His Highness, the Maharaja of Cochin in April 1947, on the condition that the Trichur Municipality will be the sole distribution licensee within the town limits and all power required for distribution will be provided by the Government.

The current license area of the TCED corresponds to the administrative limits of the old Thrissur Municipality limits covering an area of approximately 12.65sq.km, even though the administrative jurisdiction of the Thrissur Corporation covers an area of approximately 101.42sq.km.

Table 4.1 shows consumer strength and their consumption details. The Thrissur Corporation has the largest number of consumers and consumes largest share of electricity among these 9 licensees.

Table 4.1
Actual annual consumption of Licensees

Category	**Consumer strength**		**Consumption in MU**	
	Nos	**% of total consumers**	**Quantity**	**% of total consumers**
Techno park	299	0.0030	53.7	0.37
Rubber Park	30	0.0003	14.6	0.10
Kannan Devan	13047	0.1288	46.1	0.32
Thrissur Corporation	36247	0.3579	118.2	0.81
Cochin Port Trust	1368	0.0135	29.5	0.20
KINESCO	107	0.0011	46.7	0.32
CSEZ	127	0.0013	54.9	0.38
MES	-	-	50.6	0.35
Pondicherry Electricity Department	-	-	33.2	0.23
Total	51225.0	0.5058	447.5	3.08

Source: Tariff regulation commission, KSERC 2014.

The consumer base of KSEB is varied and predominantly consists of low tariff category consumers of agriculture, domestic, public lighting etc, where as the consumers of these licensees belong mainly to commercial and industrial categories. The consumption pattern of different categories of consumers of the licensees are detailed in table 4.2

Table 4.2

Category wise consumption of different consumers (in MU)

Category	**Kanan Devan**	**TMC**	**Techno park**	**Rubber park**	**CSEZ**	**CPT**	**KINESCO**	**KSEB**
Self Consumption	15.95 (47.05)	-	1.04 (2.07)	0.11 (0.49)	0.01 (0.03)	2.71 (8.80)	46.09	-
Domestic	4.39 (12.95)	31.04 (31.48)	2.65 (5.27)	-	-	1.68 (5.46)	-	6877.83 (47.27)
Commercial (LT-VI &VII)	3.58 (10.56)	60.84 (61.70)	32.51 (64.65)	0.01 (0.10)	-	6.94 (22.53)	-	1951.74 (13.42)
Public Lighting	0.24 (0.71)	3.00 (3.04)	0.15 (0.30)	-	-	-	-	256.68 (1.83)
Agriculture		0.11 (0.11)	-	-	-	-	-	231.56 (1.59)
Industrial LT	0.47 (1.39)	3.61 (3.66)	-	1.20 (5.36)	5.55 (10.21)	-	-	1053.45 (7.24)
Industrial HT	8.43 (24.87)	-	13.94 (27.72)	21.05 (94.10)	48.78 (89.76)	19.47 (63.21)	-	1622.72 (11.15)
Commercial HT	0.84 (2.48)	-	-	-	-	-	-	756.21 (5.20)
Total	33.90	98.60	50.29	22.37	54.34	30.80	-	14548.80

Source: Tariff regulation commission, KSERC 2014.

As detailed in the table 4.2, more than 95 percent of the consumers of these licensees (excluding Thrissur Corporation and Kanan Devan Hills Company Private Ltd (KDHP) are industrial and commercial consumers. Further, for Kanan Devan, the subsidized category including 'domestic and others' accounts for only 13 percent of the total consumption and for Thrissur Corporation 62 percent of the total consumers are high value commercial consumers (KSERC). However, 50.69 percent of the total consumption of KSEB is attributed to subsidized categories including domestic, agriculture, public lighting etc.

Thrissur Corporation is a local authority. Electricity Department of Thrissur Corporation is a licensee and is in the service of distribution of electricity, bought from Kerala State Electricity Board (KSEB), at affordable cost to all classes of consumers within the municipal (geographical) limits of old Trichur Muncipality. The Thrissur Municipal Corporation manages the distribution of electricity to residents and commercial establishments covering about 12 square kilometres. Thrissur Municipal Corporation and TCED are separate entities and the TCED is run on a commercial basis. The municipal corporation purchases power in bulk from the Kerala State Electricity Board (KSEB). The budget for this operation, however, is separately prepared and is not included in the annual municipal corporation budget. The separate books of accounts of the operation are also kept under the cash based system.

This chapter is divided into two sections, Section A analyses the household electricity consumption behaviour of Kerala. Section B is concerned with the awareness and practices of electricity consumption and conservation.

Section A

4.2 Household Electricity Consumption Behaviour

The study attempts to analyse the electricity consumption behaviour of the households in Kerala with special reference to Thrissur Corporation. Out of the total consumption of electricity in the state almost 49 percentage is being consumed by the household sector.

Kerala State Electricity Board has nine licensees across the state and out of these; Thrissur Corporation Electricity Department (TECD) is the only local body to provide electricity in the state. Out of the 55 wards in Thrissur Corporation, supply of electricity by TCED is almost 58 percent in 32 wards and remaining part electricity is supplied by KSEB. Out of 32 wards under TCED, three wards are Pookunam, Paravattani and Poothole which come at the top in the list on the basis of number of households. Five percent of households from each of these three wards contributed 137 sample households. In the same way three wards Ayyanthole, Koorkenchery and Cherur were selected under KSEB. Five percent each from these three wards contributed 163 sample households. Thus total sample size is 300 households in table 4.3.

Table 4.3

Study Area and Sample size

Area	Frequency
TCED	137(45.7)
KSEB	163(54.3)
Total	300

Source: Primary data

4.2.1 The socio economic profile of sample households

The sample consumers of TCED and KSEB are categorised with respect to different socio-economic variables like religion, Socio groups, gender, Type of family, economic status, house ownership, education status of family heads and type of house and plinth area (Table 4.4)

Table 4.4

The socio economic profile of sample households

Socio Economic variables	Area		Total
	TCED	KSEB	
Religion			
Hindu	83(60.6)	100(61.3)	183 (61)
Muslim	9(6.6)	16(9.8)	25 (8.3)
Christian	45(32.8)	47(28.8)	92 (30.7)
Total	137	163	300
Social Group			
OBC	59(43.1)	62(38)	121 (40.3)
SC/ST	12(8.8)	23 (14.1)	35 (11.7)
GENERAL	66(48.2)	78(47.9)	144 (48)
Total	137	163	300
Gender composition of sample population			
Male	256(49)	276(46.4)	532 (47.6)
Female	266(51)	319(53.6)	585 (52.4)
Total	522	595	1117
Type of Family			
Joint Family	31(22.6)	25(15.3)	56 (18.7)
Nuclear Family	106(77.4)	138(84.7)	244 (81.3)
Total	137	163	300
Economic Status			
APL	114 (83.2)	140 (85.9)	254 (84.7)
BPL	23 (16.8)	23 (14.1)	46 (15.3)
Education Status of Family heads			
Below S S L C	29 (21)	26 (16)	55 (18.3)
SSLC to Degree	85 (62)	113 (69)	198 (66)
Above Degree	23 (17)	24 (15)	47 (15.7)

House Ownership			
Own	134(97.8)	163(100)	297 (99)
Rented	3(2.2)	0	3 (1)
Type of House			
Pucca	110 (80.3)	128 (78.5)	238 (79.3)
Kutcha	19 (13.9)	31 (19)	50 (16.7)
Semi Pucca	8 (5.8)	4 (2.5)	12 (4)
Plinth area (Sq.ft.)			
Below 1000	39 (28.5)	64 (39.3)	103 (34.3)
1001 - 2000	78 (56.9)	78 (47.9)	156 (52)
Above 2001	20 (14.6)	21 (12.9)	41 (13.7)

Source: Primary data (Percentage shown in bracket)

Religion wise composition of sample households show that 61 percentage belong to Hindu religion, 8.33 percentage belong to Muslim religion and 30.3 percentage are from Christian religion. Both TECD and KSEB consumers constitute more or less the same proportion with respect to the three religions. On the basis of social groups (general, OBC, SC/ST), we could find that majority belonged to general category (48%).The number of households in SC/ST category is comparatively less, only 11.6 percentage and OBC category comes in the second position with 40.2 percent. The composition of social groups is more or less the same under TCED and KSEB. From this it can be inferred that our sample is a true representation of population in Thrissur district because census data 2011 for Thrissur district is similar to the above data for the different social groups.

Our sample households constitutes 1117 individuals, in which 53.27 percentage belong to KSEB and the remaining 46.73 percentage under TCED. The sex ratio of sample population is 1099.62, which is less than the district sex ratio of 1108 (Census 2011). It is found that majority of the sample households are nuclear families 81.3 percentage and the remaining 18.7 percentage are joint families.

The economic status reveals that 84.7 percentage are APL families and the remaining 15.3 percentage are BPL families. Education status of family heads is important to be noted in this research context. Here it is noted that majority of the family heads are educated under the category of SSLC to Degree with 62 percent in TCED and 69 percentage in KSEB. Of the total number of family heads, 18.33 percentage are less educated.

It is interesting to know that 99 percentage of households live in their own houses and 16.67 percentage live in kutcha houses. Majority of the households (79.3 %) have pucca houses. While considering the plinth area of the houses majority under both KSEB and TCED (47.9 % and 56.9 % respectively) are in the range of 1001 – 2000 sq.ft.

4.2.2 Electrification year of sample households

Electrification year is an important factor in the sense that when electrification period is older, the electricity wastage is larger. So upgrading electrical systems is an essential task for old houses. It is recommended to make inspection of the wiring every five years just to avoid any unexpected and unpleasant situations. But the households are not practicing such methods in general. In our sample about 65 percent households were electrified before the year 2000. Similarly 65 percent of total sample households have done electrification during 1990 to 2010. This is shown in table 4.5

Table 4.5
Electrification year

Year	TCED	KSEB
Before 1970	4 (2.9)	6 (3.7)
1971 - 1980	10 (7.3)	21 (12.9)
1981 - 1990	32 (23.4)	28 (17.2)
1991 - 2000	44 (32.1)	53 (32.5)
2001 - 2010	45 (32.8)	52 (31.9)
After 2011	2 (1.5)	3 (1.8)
Total	137	163

Source: Primary data

In TECD, out of 137 households only 2.9 percent were electrified before 1970. Also 32.8 percent of the households were electrified during the period 2000 to 2010. Out of 163 households under KSEB, only 3.7 percent of them were electrified before 1970 and 32.5 percent of the sample households were electrified in the period of 1991 – 2000.

4.2.3 Electricity Consumption among households

The details of monthly electricity consumption are given in the table 4.6.

Table 4.6

Monthly Electricity Consumption of Households

Electricity consumption Units	TCED (No. of Households)	KSEB (No. of Households)	Total
Below 250	32 (23.4)	45 (27.6)	77 (25.7)
250 – 500	83 (60.6)	103 (63)	186 (62)
Above 500	22 (16)	15 (9.2)	37 (12.4)
Total	137	153	300

Source: Primary data

Both in KSEB and TCED, monthly electricity consumption units of majority of households (62 per cent) are in the range of 250 - 500 units. Only 12.4 percent of the respondent households are consuming electricity in the range of above 500 units. The consumption of electricity among sample households varied from 60 units to 1200 units.

4.2.3.1 Electricity consumption and Social Group

Table 4.7

Electricity consumption and Social Group

Electricity consumption Units	OBC	SC/ST	Gen	Total
Below 250	26 (21.5)	19(54.3)	32(22.2)	77(25.6)
250 – 500	85(70.2)	12(34.3)	89(61.8)	186(62)
Above 500	10(8.3)	4(11.4)	23(16)	37(12.3)
Total	121(100)	35(100)	144(100)	300

Source: Primary data

The consumption behaviour of households in different social groups may differ. Among the households in the range of above 500 units of electricity consumption, general category constitutes majority (16 per cent) and SC/ST consumers in only 11.4 per cent in this consumption category. However, majority of consumers (62 per cent) come in the category of between 250 - 500 units of consumption irrespective of their social groups.

The computed chi-square value based on table 4.7 is 24.19, which is greater than the table value. Thus it can be concluded that consumption units and social groups are associated.

4.2.3.2 Electricity consumption and Type of Family

It is generally believed that joint family consists of more members and so the electricity consumption will be high. Table 4.9 reveals that out of 56 joint families, 50 per cent of families use in the range between 250 – 500 units; 42.9 per cent are in the range of above 500 units. In the case of nuclear families majority (64.7 per cent) are belonging in the consumption category of 250 -500 units. The calculated Chi-square value (66.85%) shows that these variables of electricity consumption units and type of family are associated.

Table 4.8
Electricity consumption and Type of Family

Electricity consumption Units	Joint	Nuclear	Total
Below 250	4 (7.1)	73 (30)	77 (25.6)
250 – 500	28 (50)	158 (64.7)	186 (62)
Above 500	24 (42.9)	13 (5.3)	37 (12)
Total	56 (100)	244 (100)	300

Source: Primary data

4.2.3.3 Electricity consumption and Family Size

The size of the family is another important determinant of electricity consumption. It is assumed that when the number of members in a family increases, the electricity consumption also increases. The sample households are categorised into three according to the family size that is families having three or less than three members, families with four members and family having five and more than five members. The sample constitutes 56 joint families (18.6%) and 244 Nuclear families (81.4%). It is noted that 137 nuclear families consist of three or less than three persons. Among families with 3 or less numbers 44.52 percent consume less than 250 units. And also among families who consume less than 250 units 61 (79.2%) are families with 3 or less members.

Table 4.9
Monthly electricity consumption units and Family Size

Monthly consumption units	Family Size			
	Below 3 Persons	4 Persons	Above 5 Persons	Total
Below 250	61 (44.5)	14 (15.3)	2 (2.7)	77 (25.6)
250 - 500	74 (54)	70 (77)	42 (58.3)	186 (62)
Above 500	2 (1.5)	7 (7.7)	28 (39)	37 (12.4)
Total	137 (100)	91 (100)	72 (100)	300 (100)

Source: Primary data

Table 4.9 shows electricity consumption level according to the family size categories. Among families with 3 or less members (44.5 per cent) consume less than 250 units. It is clear that 58.3 percent of the families with five or more than five members consume in the range of 250 – 500 units of electricity in a month. But majority of families (15.3 per cent) with size of four members consume less than 250 units of electricity. The monthly electricity of a family depends upon their family size.

The association between bi-monthly electricity consumption and family size was tested using Chi-square statistics. It is found that the calculated Chi-square value (98.14) is greater than table value (9.48) thus it is inferred that electricity consumption and family size are dependent.

4.2.3.4 Electricity consumption and Economic Status

Table 4.10

Monthly electricity consumption units and Economic Status

Electricity consumption units	Economic Status		Total
	APL	BPL	
0-250	54 (21.3)	23(50)	77 (25.6)
250 – 500	163 (64)	23(50)	186 (62)
Above 500	37 (14.7)	0	37 (12.4)
Total	254(100)	46(100)	300

Source: Primary data

Table 4.10 shows the economic status of the sample households. It is seen that there are no BPL households consuming above 500 units of electricity. Out of the total APL families 64 per cent consume between 250 – 500 units; 14.7 per cent consume more than 500 units.

4.2.3.5 Electricity consumption and Education

Electricity consumption level can be associated with the education status of family head, size of the family, family income and total consumption expenditure also.

Table 4.11

Electricity Consumption and Education

Electricity consumption units	Less Educated	Educated	Well Educated	Total
Below 250	12 (21.8)	55 (27.7)	10 (21.3)	77 (25.6)
250- 500	37 (67.2)	123 (62.3)	26 (55.3)	186 (62)
Above 500	6 (11)	20 (10)	11 (23.4)	37 (12.4)
Total	55(100)	198(100)	47(100)	300

Source: Primary data

Table 4.11 shows the electricity consumption according to the education status of family head. It is assumed that the education status family head is an important determined of electricity consumption (Seung, Lee 2010). Sample households are categorised in to three based o education status of family head, which is less educated (below SSLC), educated (SSLC to Degree level) and well educated (Post graduation and above). Among the families 67.2 per cent are less educated, educated (62.3) and well educated (55.3) are consume electricity between 250 – 500 units.

However the number of households in the consumption category of 250 and 500 units is more with respect to three education categories when the association between electricity consumption and education was tested using Chi-Square value (7.17) is less than the critical value (9.49) thus it is inferred that electricity consumption and education status are not associated.

4.2.3.6 Electricity consumption and Family Income

Family income of the households is calculated by adding monthly income of all members in the family and it varied between 7000 and 165000 rupees among them. Family income can also be one of the determinants of electricity consumption. So these are related in table 4.12. Sample households are categorised into three on the basis of family income majority 208 (69.3%) included in the income category of below

50 thousand rupees per month. Of these households, majority (62.5%) are using 250 to 500 units of electricity. Also it is seen that majority of households in the income category of above 1 lakh rupees are consuming more than 500 units of electricity (56.25%).

H_0: There is no association between Monthly electricity consumption units and family income.

The relationship between electricity consumption and family income is tested using chi- square statistics. The computed value of chi-square statistics (63.55) is greater than the critical value, which reveals that these two variables are dependent.

Table 4.12

Monthly electricity consumption Units and Family Income

Monthly units	family income (Rs ,000)			Total
	Below 50	50 – 100	Above 100	
Below 250	69 (89.6)	6 (7.8)	2 (2.6)	77 (100)
250 – 500	130 (69.90)	51 (27.40)	5 (2.70)	186 (100)
Above 500	9 (24.3)	19 (51.3)	9 (24.4)	37 (100)
Total	208 (69.3)	76 (25.3%)	16(5.4%)	300

Source: Primary data

4.2.4 Electricity Bill Amount

The billing procedure for bi-monthly of domestic consumers is based on Telescopic and Non-Telescopic tariff system, which were discussed chapter 3. As per this system, the billing is not proportion to the consumption units, but on the basis of consumption slabs. In this context the analysis using bill amount is also necessary.

4.2.4.1 Electricity Bill and Consumption Expenditure

The bill amount of the households varied between 173 rupees to 10000 rupees from table 4.13 it is relived that (43.67%) of households have paid between 1000 to

2000 rupees as electricity bill. Electricity consumption expenditure can be associated with total consumption expenditure of the households. On the basis of total household consumption expenditure, the sample households are categorised in to two that is households having 5000 and below 5000 rupees as consumption expenditure and households having above 5000 rupees. When total consumption expenditure is high, electricity consumption expenditure is likely to be high. Out of 300 households in the upper consumption expenditure category, majority of the household (36.67%) are having electricity consumption expenditure of above 5000 rupees. To test the association between these two variables, following hypothesis is stated.

H_0: There is an association between monthly electricity bill and total household consumption expenditure.

The computed Chi- square value (137.75) relives that the association between monthly electricity bill and consumption expenditure are not independent.

Table 4.13
Monthly Electricity bill and Consumption Expenditure

Monthly Electricity bill amount	Consumption Expenditure (Rs)		Total
	Below 5000	Above 5000	
Below 500	82 (97.6)	2 (2.4)	84 (100)
501 -1000	127 (97)	4 (3)	131 (100)
1001 - 1500	45 (88.2)	6 (11.8)	51 (100)
1501 - 2000	13 (92.9)	1 (7.1)	14 (100)
2001 - 2500	1 (14.3)	6 (85.7)	7 (100)
Above 2501	2 (15.4)	11 (84.6)	13 (100)
Total	270 (90)	30 (10)	300 (100)

Source: Primary data

In this context a simple regression model was fitted to analyse the magnitude and direction of the relationship between monthly electricity consumption expenditure and total monthly household consumption expenditure. The results are given in table 4.14

4.2.4.1.1 Simple linear Regression Model

$$Y_i = \alpha + \beta X_i + \mu_i$$

Y_i = Monthly Consumption expenditure on Electricity

X_i = Total Monthly consumption expenditure of Household

Table 4.14

Simple linear Regression Model

TCED	KSEB
$Y_i = 32.78 + 0.186\ X_i$ SE = (38.29) (0.006) t= (0.85) (30.61) R^2 =0.87 F = 937.53	$Y_i = 326.46 + 0.12\ X_i$ SE = (50.99) (0.008) t = (6.4) (13.58) R^2 =0.53 F = 184.52
KSEB & TCED	
$Y_i = 202.54 + 0.14\ X_i$ SE = (35.51) (0.005) t = (5.7) (25.44) R^2 =0.68 F = 647.4	

When we consider 300 households, 68 percentage of variation in their electricity consumption expenditure is determined by variation in their total

consumption expenditure (R^2 = 0.68). Here total consumption expenditure is highly significant in determining the electricity consumption expenditure. When we compare TCED and KSEB consumers the relationship is more significant in the case of TCED consumers.

4.2.4.2 Electricity bill and Purpose of Electricity usage

The households are using electricity mainly for household purpose but in some cases they are using electricity also for other purposes that are agriculture and small business within the households. So the sample households are categorised in to different groups on the basis of purpose of electricity use as seen table 4.15

Table 4.15

Monthly Electricity bill and Purpose of Electricity usage

Monthly Electricity bill amount	Purpose of Electricity usage (No. of households)		
	Household Purpose	Household and other Purpose	Total
Below 500	80 (95.2)	4 (4.8)	84
501 -1000	119 (90.8)	12 (9.2)	131
1001 - 1500	35 (68.6)	16 (31.4)	51
1501 - 2000	11 (78.6)	3 (21.4)	14
2001 - 2500	2 (28.6)	5 (71.4)	7
Above 2501	5 (38.5)	8 (61.5)	13
Total	252 (84)	48 (16)	300

Source: Primary data

To analyse the association between monthly electricity bill and purpose of electricity usage, Chi-Square test for independence was used.

H_0: There is no association between monthly electricity bill and purpose of electricity usage.

It is seen that (79.17%) of households in the category of household and other purpose are making payments of above 2000 rupees for electricity consumption while it is only (21.03%) in the category of 'household purpose only'. The association between these two variables are tested and it is found that (57.78%) these variables are not independent.

4.2.7 Electricity bill and family income

Table 4.16

Monthly Electricity bill and family income

Monthly Electricity bill	family income (Rs '000)			Total
	Below 50	50 - 100	Above 100	
Below 1000	78 (92.9)	6 (7.1)	0	84
1001 – 2000	103 (78.6)	25 (19.1)	3 (2.3)	131
2001 – 3000	19 (37.3)	26 (51)	6 (11.7)	51
3001 – 4000	6 (42.9)	7 (50)	1 (7.1)	14
4001 - 5000	1 (14.3)	4 (57.1)	2 (28.6)	7
Above 5000	1 (7.7)	8 (61.5)	4 (30.8)	13
Total	208 (69.3)	76 (25.3)	16 (5.4)	300

Source: Primary data

The table 4.16 shows that the monthly electricity bill ranging from rupees below 1000 is high (92.9 %) in the families having their income between Below 50000 rupees. In the case of the electricity bill between 1001 and 2000, it is again higher (78.6 %) for the same families. The number of families with income between 50000 to 100000 rupees is more (51.0 %) when the monthly electricity bill of rupees 2001 – 3000 is considered. The electricity bill that ranges from 3001 to 4000 is high (50.0 %) for the same families again. In the case of electricity bill ranging from 4001 to 5000 and families lead (that is 57.1 per cent and 61.5 per cent respectively).

4.2.8 Payment Mode of Electricity Bill

At present the system of cashless economy and digitalization promote the people to make online payments. About 22 percent of households have tried online payment of electricity bill. But majority of the households make payment directly at the office.

Table 4.17

Payment mode of bill

Payment mode of bill	TCED	KSEB
Walk in Office only	109 (79.6)	123 (75.5)
Online Payment only	12 (8.8)	5 (3.1)
Walk in office and Online payment	14 (10.2)	33 (20.2)
Walk in office and Friends	1 (0.7)	1 (0.6)
Walk in office, Online payment and Mobile banking	1 (0.7)	1 (0.6)
Total	137 (100)	163 (100)

Source: Primary data

The mode of payment of electricity bill is higher for walk in office for both TCED (79.6) and KSEB (75.5).

4.2.5 Type of connection

Households are using two types of connections, that are single phase and three phase. There is a ‘fixed charge’ for type of connection, which are paid by the consumer with electricity bill. The present revised charge for single phase is Rs 30 and that for three phase is Rs 80. The connection type can be related to the family income as well as the purpose of electricity usage.

4.2.5.1 Connection type and Family Income

Table 4.19 shows the details of connection type and family income. Among the families with income below 50 thousand rupees, families with single phase connections are (76.4 %) more in number. In the case of income ranging from 50000 to 100000, three phase connection is the widely used (64.5 %). Those with income of above 1lakh rupees, all families are using three phase connections.

Table 4.18

Connection Type and family income

Family Income (Rs '000)	Connection Type		Total
	Single Phase	Three Phase	
Below 50	159 (76.4)	49 (23.6)	208
50 – 100	27 (35.5)	49 (64.5)	76
Above 100	0	16 (100)	16
Total	186 (62)	114 (38)	300

Source: Primary data

4.2.5.2 Connection type and Purpose of Electricity Usage

Table 4.20 relates the connection type and purpose of electricity usage. Among the consumers in the category of 'household purpose', 67.9 percentage have single phase connection and 32.1 percentages are having three phase connection. Majority of the consumers (66.7%) in the category of 'household and other purpose' are using three phase connection. Chi- square statistic was used to test the hypothesis.

H_0: There is no association between purpose of electricity usage and connection type.

The calculated Chi- square value (22.93) is higher than the critical value (3.84). Thus it is found that connection type and purpose are associated.

Table 4.19

Purpose of Electricity usage and Connection Type

Purpose of electricity usage	Connection Type		Total
	Single Phase	Three Phase	
Household Purpose	171 (67.9)	81 (32.1)	252
Household and Other Purposes (Agriculture, Business)	15 (33.3)	33 (66.7)	48
Total	186 (62)	114 (38)	300

Source: Primary data

Table 4.19 shows that, 67.9 per cent of the respondents are using single phase connection for household purpose. 66.7 per cent of them use three phase for agriculture and business purposes.

4.2.6 Purpose of Electricity Usage and Nature of Family

The purpose category of 'household and other purposes' includes 40 percent from joint family and 60 percent from nuclear family. Also among the joint families, 33.43 percent use electricity for 'household and other purposes' while it is only 11.89 percent among nuclear families.

H_0: There is no association between nature of family and purpose of electricity usage.

The computed Chi-square value 16.46 reveals that the purpose and type of family are significantly associated.

Table 4.20

Purpose of Electricity usage and Nature of the Family

Purpose	Nature of the Family		Total
	Joint Family	Nuclear Family	
Household Purpose	37(14.7)	215 (85.3)	252
Household and Other Purpose (Agriculture, Business)	19 (40)	29 (60)	48
Total	56 (18.7)	244 (81.3)	300

Source: Primary data

4.2.7 Plinth area of house and Plug points

It is found that 97.1 percent of domestic consumers use less than 10 plug points with their plinth area of house ranging below 1000 sq.ft. In the case of plinth area of house ranging from 1001 – 2000 sq.ft, less than 10 plug points are used (62.8 %). Among those with above 2000 sq.ft, plinth area of house 78 percentage use more than 10 plug points.

Table 4.21

Plinth Area of House and plug points

Plinth Area (Sq.ft)	Plug points		Total
	Below 10	Above 10	
Below 1000	100(97.1)	3 (2.9)	103
1001 - 2000	98 (62.8)	58 (37.2)	156
Above 2000	9 (22)	32 (78)	41
Total	207 (69)	93 (31)	300

Source: Primary data

4.2.8 Multiple Regression Analysis – Determinants of Electricity Consumption Expenditure

Since Chi Square doesn't provide the direction of association, we cannot infer whether these socio-economic variables are related positively or negatively to electricity consumption expenditure. Therefore we use multiple regression analysis to test the relationship in detail. Here we do the regression analysis by considering the important socio-economic variables like family size, education status of family head, purpose of electricity usage and family income, which can be the determinants of electricity consumption expenditure.

$$\mathbf{Y_i = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + u_i}$$

Yi = Monthly Consumption expenditure on Electricity

X1 = family size

X2 = Education Status of family heads

X3 = Purpose of electricity usage

X4 = Family Income

U = Random error term

Table 4.22

Multiple Regression Analysis

Estimates	TCED	KSEB	Both
R^2	0.54	0.46	0.50
α	-318.78	-463.35	-422.7
β_1	91.62	170.42	134.4
SE	56.38	39.50	32.7
t	1.62	4.31	4.1
β_2	-54.75	-6.51	-26.75
SE	32.75	25.71	20.34

t	**-1.67**	**-0.25**	**-1.31**
β_3	**280.20**	**252.91**	**265.05**
SE	**104.78**	**127.72**	**78.38**
t	**2.67**	**1.98**	**3.38**
β_4	**0.015**	**0.007**	**0.01**
SE	**0.002**	**0.002**	**0.001**
t	**7.34**	**4.63**	**8.93**
F	**39.12**	**34.53**	**74.93**

Source: Primary data

The regression results are given in table 4.22. In the case of TCED consumers R^2 value is comparatively higher, suggesting that these socio-economic variables are more important in determining electricity consumption expenditure. All the factors except education status of family heads are positively related to the electricity consumption expenditure in the case of both KSEB and TCED consumers. The factors, purpose of electricity usage and family income are more significant among TCED consumers while family size and family income are the most significant factors in determining electricity consumption expenditure among KSEB consumers.

4.2.9 Satisfaction level of consumers

The level of satisfaction among consumers in the services provided by the departments is evaluated using an index worked out on the basis of responses of consumers. We use index as value given in various satisfaction levels like good, bad or satisfy for 2, 0 and 1 respectively and Multiplied with number of households given the satisfaction level.

Table 4.23

Satisfaction level of consumers in the services of TCED & KSEB

Electricity Consumption Units	TCED	KSEB
Below 250	90	87
250 – 500	86	80
Above 500	91	65

Source: Primary data

Table 4.23 depicts the variation in level of satisfaction with respect to different categories of consumption units. It is clear that in all categories of consumption, the level of satisfaction of TCED consumers is higher when compared to that of KSEB consumers. When the consumption level increases, the difference in the level of satisfaction of TCED & KSEB consumers are increases favouring the TCED consumers.

This mean that compared to KSEB, the TCED perform better in providing consumer benefits. The TCED arrange more seminars and classes to the consumers on awareness of electricity conservation practices. Also the conservation efficient equipments like LCD and LED bulbs, tubes and fans are distributed at subsidised rate to the consumers. Also the TCED has been promoting the use of solar energy by providing a loan of Rs 50000 rupees without interest for purchasing solar panels.

Section B

4.3 The electricity conservation practices of Kerala

Energy conservation means the saving of the quantity of energy used for different purpose. This practice may result in increase of financial reduction in expenditure or well being measure in environmental value, national and personal security and human comfort. Individuals and organizations that are direct consumers of energy may want to conserve energy in order to reduce energy costs and there by directly or indirectly promote economic, political and environmental sustainability.

Industrial and commercial users may want to increase efficiency and thus maximize profit. Saving electricity becomes an increasingly important issue in the context of increasing cost of power. Today the price of all forms of energy has been increasing and the case of electric energy is not different. The scarcity of electricity also leads to the increasing price and it affects the domestic consumers to a great extent. At this juncture, it is a necessary to save electricity by adopting good conservation practices.

At present, the Board imports around 57 million units of power to meet the daily demand. Of this 29MU, the state get as central share and the rest is brought to the state through long, medium and short-term power purchases. The sharp dip in rains has upset the plans of the Board. Another problem is that power corridors getting congested in the peak of summer, curtailing power evacuation limits from other states. Purchasing power from National Thermal Power Corporation (NTPC) and Kayamkulam at higher price leads to cost overruns and burdens one for the Board.

4.3.1 Awareness and Practice Regarding Electricity Conservation

In this section an attempt is made attempt to analyse the awareness and also about the practice of consumers regards electricity conservation. For the purpose of the study, the researcher divided the factors related to electricity conservation into four, those with regard to light and fan, kitchen gadgets, home appliances and alternative energy source. Lights, fan, computers and other home appliances use a lot of electricity. Electricity can be saved by turning off lights and fan when it is not used. Electric energy can be conserved while using lights and fan, kitchen gadgets and other home appliances if we are aware about certain good practices. Also awareness about alternative energy sources helps to conserve electric energy. The table 4.25 shows the mean score of KSEB and TCED household consumers' awareness and practice regarding electricity conservation.

4.3.1.1 Electricity Conservation Awareness of Households

Table No. 4.24

Electricity conservation awareness in KSEB and TCED: Mean Score

Sl. No.	Factors	KSEB	TCED
Lights and Fan			
1.	Switch off bulb/tube when not in use	2.95	3.61
2.	Use of CFL/LED lights	4.02	4.08
3.	Using zero watt bulb	1.64	2.92
4.	Careless use of bulb tube during day time	3.48	3.39
5.	Use of fans at full speed	2.78	3.18
6.	Light coloured walls reflect more bright lights	3.00	3.35
7.	Use of electronic choke reduce power consumption	2.93	3.91
8.	Cleaning of bulb and tube periodically	3.04	3.72
Kitchen Gadgets			
9.	Putting hot dishes into fridge	2.14	3.60
10.	Use of mixer grinder overload mode	2.57	2.88
11.	Using energy saving gadgets in the kitchen	2.52	3.88
12.	Avoid frequently closing/ opening doors of fridge	2.61	3.82
13.	Switch off fridge at peak time	2.07	3.61
Home Appliances			
14.	Bulk ironing of cloths	3.77	3.67
15.	Using star labelled gadgets	2.58	3.60
16.	Use of capacitors for water pumps	2.75	3.23

17.	Computers sleep mode when not in use	4.05	3.73
Alternative energy sources			
18.	Using renewable alternative source	2.93	3.74
19.	Use of solar water heater	2.89	3.71

Source: Primary Data

Under the factor, 'lights and fan', both KSEB and TCED household consumers have more awareness about the use of CFL or LED lights.CFL and LED lights help to reduce electricity consumption. They have less awareness about using zero watt bulbs. Zero watt bulbs consume more electricity than CFL or LED. Awareness on electric choke is comparatively lower among KSEB consumers.

In the case of Kitchen Gadgets, KSEB consumers have more awareness about avoiding frequent closing or opening of doors of refrigerator (2.607). The frequent use of refrigerator consumes more electricity. They have less awareness about switching off refrigerator (2.067) at peak time (during 6 pm to 10 pm) which helps to save energy. Both KSEB and TCED household consumers have more awareness about putting computers in sleep mode when not in use and using of alternative sources of energy. But awareness on using star labelled gadgets and capacitor for water pumps is more among TCED consumers (3.60). Table 4.26 shows KSEB and TCED household practices for electricity conservation.

4.3.1.2 Electricity Conservation Practices of Households

Table No. 4.25

Practices of Household Consumers in KSEB and TCED regarding electricity conservation: Mean Score

Sl. No.	Factors	KSEB	TCED
Lights and Fans			
1.	Switch off bulb/tube when not in use	3.44	3.78
2.	Use of CFL/LED lights	3.70	4.15

3.	Conscious while using zero watt bulb	1.86	2.96
4.	Avoid careless use of bulb tube during day time	3.12	3.50
5.	Use of fans at sufficient speed to utility	2.72	3.51
6.	Light coloured walls	3.02	3.96
7.	Use of electronic chock	2.86	3.95
8.	Cleaning bulb/tube periodically	2.97	3.91
Kitchen Gadgets			
9.	Not putting hot dishes into fridge	2.21	3.79
10.	Avoid frequently closing/ opening doors of fridge	2.88	3.68
11.	Not using of mixer grinder in overload mode	2.69	2.92
12.	Switch off fridge at peak time	2.68	3.61
13.	Using energy saving gadgets in kitchen	2.50	3.96
Home appliances			
14.	Bulk ironing of cloths	3.93	3.69
15.	Using star labelled gadgets	2.67	3.36
16.	Use of capacitors for water pumps	2.74	3.28
17.	Computers sleep mode when not in use	2.67	3.70
Alternative Energy Sources			
18.	Use of solar water heater	2.73	3.67
19.	Using renewable alternative source	2.32	3.14

Source: Primary Data

It is found that the mean score for practice among TCED consumers is more with respect to all practice except ‘bulk ironing of cloths’. Under the factor ‘lights and fan’, the highest mean score is for the item ‘use of CFL/LED lights’ in the case of both KSEB (3.70) and TCED (4.15). When the factor ‘kitchen gadgets’ is considered, the item ‘avoid frequent closing/opening of refrigerator’ shows the highest mean score among KSEB consumers (2.88). But the highest mean score of this factor among TCED consumers is to the item ‘using energy saving gadgets in kitchen (3.96).

4.3.2 Awareness and practice of sample Households

H_0: There is no relationship between awareness and practices of KSEB consumers towards electricity conservation

Correlation coefficient was used to test the hypothesis. The test result is given in the following table 4.26.

Table: 4.26

Awareness and practice of KSEB Households: Correlation result

Electricity Conservation	Awareness		Practices	
	KSEB	TCED	KSEB	TCED
Awareness	1	1	0.961**	0.973
Practices	0.961**	0.973	1	1

*Source: Primary Data, ** significant at 0.01 level*

The correlation coefficient between awareness and practices of KSEB consumers on electricity conservation is .961. It indicates high positive relation between awareness and practices of KSEB consumers towards electricity conservation at 1 per cent level of significance.

4.3.3 Awareness and Practice of TCED households

H_0: There is no relationship between awareness and practices of household consumers in TCED with regard to electricity conservation.

Correlation coefficient test was used to analyse the relationship between awareness and practice regarding energy conservation among TCED household consumers.

The correlation coefficient between awareness and practice of household consumers in TCED regarding electricity conservation is 0.973, denoting high positive correlation at 1 per cent level of significance. Hence, there is a positive correlation

between awareness and practices of TCED household consumers with regard to electricity conservation.

H_0: There is no significant difference between KSEB and TCED consumers with respect to awareness of electricity conservation.

Independent Sample t test was applied to analyse the significant difference between KSEB and TCED household consumers' awareness about electricity conservation. The test result is given in table 4.27.

Table No. 4.27

Awareness of Sample Consumers

Awareness	Mean	t Value	P value	Inference
KSEB	57.68	-10.24	0.000**	Highly Significance
TCED	68.40			

*Source: Primary Data, ** Significant at 1 % level*

Since, p value is less than 0.01; the null hypothesis is rejected at 1 per cent level of significance. Hence it is concluded that there is significant difference between KSEB and TCED household consumers with respect to awareness of electricity conservation. Based on mean score TCED (68.40) household consumers have better awareness than KSEB household consumers about electricity conservation

H_0: There is no significant difference between KSEB and TCED consumers with respect to practices of electricity conservation

Independent Sample t test was applied to test the difference between KSEB and TCED consumers in the electricity conservation practices.

Table No. 4.28

Practices of Sample consumers

Practices	Mean	t Value	P value	Inference
KSEB	56.63	-13.41	0.000**	Highly Significant
TCED	67.89			

Source: Primary Data, ** Significant at 1% level

Here, the p value is 0.000. The null hypothesis is rejected at 1 per cent level of significance. Hence there is a significant difference between KSEB and TCED consumers with respect to electricity conservation. Based on mean score TCED consumers (67.89) is better than KSEB consumers with regard to the practices of electricity conservation

4.3.4 Independent Samples t Test

H_0: There is no significant difference in both KSEB and TCED household consumers in awareness and practices regarding electricity conservation.

Independent sample t test was used to analyse the house hold consumers' awareness and practices with respect to electricity conservation.

Table 4.29

Awareness and Practices of household consumers regarding electricity conservation

Electricity conservation	Area	Mean score	t value	P value	Inference
Awareness	KSEB	57.68	-7.539	0.000**	Highly significant
	TCED	68.40			
Practices	KSEB	56.63	-8.287	0.000**	Highly significant
	TCED	67.89			

*Source: Primary Data, ** Significant at 1 % level*

Here, the p value of awareness and practice of household consumers is less than 0.010. Hence, the hull hypothesis is rejected at 1 per cent level of significance. The result shows significant differences in both KSEB and TCED household consumers' awareness and practices with respect to electricity conservation. Based on mean score, TCED household consumers (68.40) have more awareness than KSEB household consumers about electricity conservation. And TCED household consumers are better than KSEB consumers regarding the practices of electricity conservation methods.

4.3.5 Awareness and Practice about electricity conservation:

The regression model used in this context is $\mathbf{Y_i = \alpha + \beta X_i + U_i}$ where $\mathbf{Y_i}$ = mean score value of electricity conservation practice of i^{th} consumer and $\mathbf{X_i}$ = the mean score value of awareness of i^{th} consumer. The Regression results are given in table 4.30.

Table 4.30
Awareness and Practice – Regression Results

TCED	KSEB
$\mathbf{Y_i = 0.877 + 0.98X_i}$	$\mathbf{Y_i = 5.861 + 0.88X_i}$
SE = (1.39) (0.02)	**SE = (1.173) (0.02)**
t = (0.63) (48.90)	**t = (4.996) (44.29)**
R = 0.973	**R = 0.961**
$\mathbf{R^2 = 0.947}$	$\mathbf{R^2 = 0.924}$
F = 2391.97	**F = 1961.74**

H_0: Practices of household consumers in KSEB and TCED is not depending on awareness about electricity conservation.

This table provides the R and R^2 values. The R values of KSEB and TCED represent the simple correlation and are 0.961 and 0.973 respectively, which indicate a high degree of correlation. The R^2 value indicates how much of the total variation in the dependent variable 'practices' can be explained by independent variable, 'awareness'. In this case, for KSEB, 92.4 per cent and for TCED, 94.7 per cent can be explained which is considerably large.

Here, the p value of KSEB and TCED are less than 0.05, and it indicates that the regression model statistically significantly predicts the outcome variable. So it is good fit for the data. Hence, there is a significant linear relationship between the variables awareness and practice of household consumers in both KSEB and TCED.

4.3.6 Energy Saving Estimation

From the analysis of awareness and practice of electric energy conservation, it is understood that awareness and practice are very much related. But there is a significant difference in the levels of both awareness and practice between TCED and KSEB consumers. This difference might be revealed in the use of energy saving gadgets and thus the amount of energy savings. So it is important to look in to this matter also.

Table 4.31

Gadgets Used in households

Categories	Number of Gadgets	
	TCED (137 HH)	KSEB (163 HH)
Incandescent Bulbs	140	172
CFL lights	1958	2157
Tube Lights	667	825
Fans	680	812

Source: Primary Data

Table 4.31 shows the total number of bulbs/tubes and fans used in the sample households. Among three types of light sources, CFL is the most energy saving source. Since the number of sample households under KSEB is more than that under TCED, the number of gadgets is more under KSEB.

Table 4.32

Estimation of electric energy saved by using CFL (per Day)

TCED				
Watt	No. Of Lights	Using time/day	Total Hrs	Electric Energy
60 w	1958	6 hrs	11748 hrs	704.88 Units
18 w	1958	6 hrs	11748 hrs	211.46 Units
704.88– 211.46 = 493.42 Units				
KSEB				
Watt	No. Of Lights	Using time/day	Total Hrs	Electric Energy
60 w	2157	6 hrs	12942 hrs	776.52 Units
18 w	2157	6 hrs	12942 hrs	232.95 Units
776.52 – 232.95 = 543.57 Units				
Average unit of electricity conserved in TCED / Household = 3.60 Units				
Average unit of electricity conserved in KSEB / Household = 3.30 Units				

Source: Primary data

Table 4.32 explains the average units of electric energy conserved under TCED and KSEB by using CFL. The power of CFL is 18W while that of incandescent bulb providing same light effect is 60W. When TCED households use 1958 CFLs, they could save 493.42 units of electric energy over incandescent lamps. At the same time, the KSEB consumers use 2157 CFLs and they could save 543.57 units over incandescent lamps. When we calculate the average electric energy conserved per each household under TCED and KSEB, it is revealed that the average saving is more (3.60 units) among TCED consumers than among KSEB consumers (3.30 units). When converted into money terms with the unit price in Kerala in 2014 (Rs 3.75) price of

electricity a family can save approximately 12 rupees per day if they use 15 CFL/ LED lights instead of incandescent bulbs for 6 hrs per day.

Usage of star rated gadgets is another important method to save electric energy. Refrigerator, Motor pump, Iron box, Washing machine, Air Condition and Electronic heater are the star rated gadgets used in the households. The use of star rated gadgets is more among TCED consumers (55.4%).

Table 4.33

Star rated Appliances Use in TCED

Star rated gadgets	No. Of Gadgets	Total hrs used/day	Using Star Rated Gadgets (units)	If Not using Star rated	Energy Saved
Refrigerator	75	1500	300	435	135
Motor Pump	75	33.75	25.14	37.73	12.59
Iron box	63	31.5	23.6	31.5	7.9
Washing Machine	56	56	28	42	14
Air condition	34	102	91.8	153	61.2
Electronic Heater	23	23	11.5	17.25	5.75
Total	326	1646.25	480.04	716.48	236.44

Source: Primary Data

Table 4.33 explains the amount of energy saved by TCED consumers by using star labelled gadgets. The energy saved is more in the case of refrigerator (135 units), which is followed by AC (61.2 units). From this, it is understood that the TCED consumers could save 236.44 units of electricity per day by using star rated gadgets.

But in the case of KSEB consumers, the total amount of energy saved per day is 152.5 units

Table 4.34

Star rated Appliances Used in KSEB

Star rated gadgets	No. Of Gadgets	Total hrs used/day	Using Star Rated Gadgets (units)	If Not using Star rated Gadgets	Energy Saved
Refrigerator	51	1020	204	295.8	91.8
Motor Pump	51	22.95	17.1	25.65	8.55
Iron box	50	25	18.75	25	6.25
Washing Machine	34	34	17	25.5	8.5
Air condition	24	72	64.8	97.2	32.4
Electronic Heater	20	20	10	15	5
Total	230	1193.95	331.65	484.15	152.5

Source: Primary Data

Here we see a difference of 83.94 units of electricity saved between TCED and KSEB consumers. In this context we can relate the higher awareness and practice levels of electricity conservation among TCED consumers with higher amount of energy saving.

4.4 Conclusion

Electricity consumption behaviour is influenced by family size and family income of the households. When electricity conservation practices are considered, 'awareness' is an important factor. The local government body (Thrissur Corporation) has an important role in creating awareness among the consumers under TCED. The awareness and practice among TCED consumers is more evident from the fact that

they could save more electric energy from conservation practices than the KSEB consumers.

Independent Sample t test was applied to analyse the significant difference between KSEB and TCED household consumers' awareness about electricity conservation. There is significant difference between KSEB and TCED household consumers with respect to awareness of electricity conservation. Independent Sample t test was applied to test the difference between KSEB and TCED consumers in the electricity conservation practices. It is found that, there is a significant difference between KSEB and TCED consumers with respect to electricity conservation. Chi- Square test result shows that awareness and practice are significantly associated, when the level of awareness increases, the level of conservation practices increases. Regression analysis was used to test the hypothesis that practices of household consumers in KSEB and TCED is depending on awareness about electricity conservation. The result shows that, there is a significant linear relationship between the variables awareness and practice of household consumers in both KSEB and TCED.

5.1 Introduction

Electrical energy is undisputedly the most vital element for industrial growth of any country. India is one of the many developing countries, which is suffering from acute power shortages. Almost all the states of India are not able to manage the demand from different sectors, viz., domestic, agriculture industrial and service sectors. The recent industrial growth due to economic reforms further worsened the situation.

Kerala is a state whose primary energy source is electricity generated from its hydroelectric projects. Till mid 1980's Kerala was a state with excess supply of electricity which was sold to its neighbouring states. But from 1985 onwards the trend started reversing mainly due to the unprecedented increase of household users basically due to the massive home electrification campaigns by the state government. Currently the state faces acute shortage of electricity in summer especially in the years of monsoon failures. Adding fuel to the fire, misuse/defective use of electricity by the consumers, lack of awareness of the people regarding the need to save electricity, increased usage of modern electric gadgets and home appliances etc made the crisis much worse. Many times the government and Kerala State Electricity Board (KSEB) which is the monopoly electricity supplier in the state are forced to increase the tariff rates, impose power cuts and load shedding etc.

Kerala State Electricity Board (KSEB) is the main channel to allocate the electricity needs in the state. The increase in demand will increase the average cost of supply, because of the declining share of hydropower and the need to buy costlier thermal power from other states. This can put further pressure on the financial position of the Board, or it will be forced to reduce the quality/quantity by not buying adequate power from the national grid. KSEB bear heavy burden, while importing electricity from other states. In this context it is needed to conserve electric energy by using energy saving equipments as well as depending on renewable sources of energy. The local governments have to play important role along with KSEB to promote energy saving practices especially among household consumers. This research thesis titled

“Household Electricity Consumption and Conservation Practices in Kerala: A Performance analysis of Kerala State Electricity Board” focuses these issues related to electric energy supply and demand.

The main objectives of the study are to analyse the financial and physical performance of Kerala State Electricity Board during 2004-05 to 2014-15, to assess the pricing methods adopted by Kerala State Electricity Board, to examine the Household electricity consumption behaviour in Thrissur Corporation and to compare the electric energy conservation practices among households under KSEB & TCED (Thrissur Corporation Electricity Department which is a licensee of electricity supply under Thrissur corporation).

The methods adopted for the study includes both descriptive and analytical. The Electricity Act 2003 marks a watershed in the Indian Power Sector, with fundamental and far-reaching impacts on reform, deregulation and restructuring. The financial performance of the Board during the period from 2004-05 to 2014-15 is analyzed using time series data drawn from various financial statements provided in the annual accounts. Estimates of annual trend and financial ratios have been used for this purpose. The cost of production and supply of electricity among different categories of consumers are analyzed in detail using simple arithmetic methods. Primary data were collected from household electricity consumers in Thrissur corporation area. Thrissur Corporation is one of the 9 licensees of procuring energy from KSEB at bulk tariff and supply energy to the consumers. Thrissur Corporation is the only local government authority in Kerala which undertakes this task of electricity supply. It is noticed that Thrissur Corporation electricity department (TCED) is the electricity provider to the consumers in 32 wards in Thrissur Corporation, which were the area under old Thrissur Municipality. The remaining 23 wards in Thrissur Corporation are under KSEB where KSEB is the authority for electricity supply. For the purpose of the study we selected 300 households from Thrissur Corporation, 5 percent each from 3 wards of TCED and 3 wards of KSEB area.

Electricity consumption behaviour of the households is analysed with respect to the socio-economic variables like religion, social groups, type of family, economic status, education, income etc... Chi square test is used to study whether there is any association between electricity consumption and the socio- economic variables. Also a multiple regression analysis has been done to find out the significant determinants of electricity consumption expenditure of households. To study the dependence of electricity consumption expenditure on total consumption expenditure, a simple regression model was fitted.

Awareness and Practices of households regarding electricity conservation are measured using 5 point likert scale measure. In this context a comparative study of TCED and KSEB consumers was made using t test and the dependence of practice on awareness is analysed using simple regression function. Also the electric energy saved using conservation practices are computed to compare the KSEB and TCED consumers.

5.2 Major Findings

Following are the major findings on the basis of the objectives of the study.

5.2.1 Physical Performance

The study period is 10 years after the regulation Act 2003 which is from 2004 - 05 to 2014 -15. The physical performance of the board is studied by taking the major components like generation, transmission, distribution, Transmission and Distribution Loss (T&D Loss), Aggregate Technical and Commercial Loss (AT & C Loss) and consumers Load connection.

During 2015-16, the total installed capacity of electric energy source in the state is 2890.50 MW, the sources being Hydel (2046.15), Thermal (159.96) and Wind (2.025). The contribution of State sector is 2209.2 MW (76.7 per cent), Central sector 359.6 MW (12.4 per cent) and Private sector 311.31 MW (10.8 per cent).The energy requirement including all categories of consumers as well as energy availability in the

state have grown at Compound Annual Growth Rate (CAGR) of 4.9 percent and 5.2 percent respectively based on data from FY 2009-10 to FY 2014-15 furnished by the state.

Installed capacity of electricity in India is mainly from Thermal power stations (68%) but in Kerala, 73 percent of installed capacity is from Hydro electric power plants. In India, major electricity consumption is by the industrial sector (45%) while in Kerala, the predominant electricity consumption is by the domestic household sector (49%)

Per Capita Electricity consumption in India increased from 329 kWh to 981 kWh during 1990-91 to 2015-16. In Kerala, it increased from 185 kWh to 565 kWh during the same period. Transmission and distribution losses have decreased from 26.22 percent to 14.32 percent during the period from 2004-05 to 2014-15.

As a result of decrease in Transmission and Distribution (T & D) loss reduction, the electricity saving is occurred at an average annual growth (CAGR) of 19.94 percent. Aggregate Technical and Commercial Loss (AT & C) has decreased from 32.73 percent in 2003-04 to 17.28 percent in 2014-15. While T & D loss has decreased from 26.22 percent to 14.32 percent during the same period. Physical performance has improved over the period 2004-05 to 2014-15. But the elasticity of electricity generation is less than the elasticity of electricity consumption, so the dependency on external sources to fulfil their requirement is in an increasing pace.

5.2.2 Financial Performance

The financial performance of the most of the SEBs including KSEB did not remain very attractive over the period of time. Because of their inability to generate revenue surplus, the commercial losses increased rapidly. Under the pressure of state government, the tariff for some category of consumers such as agriculture and domestic sector was kept very low in comparison to the cost of supplying power.

We considered major variables like cost of power supply, revenue gap, subsidy and cross subsidy. The result shows that the cost of power supply had been increasing

during the study period from 8 percent in 2004-05 to 12 percent in 2014-15 and the revenue gap was widening over the period from Rs -342.76 crores to Rs-2136.68crores.

Financial ratios are used to analyse the financial performance. Current ratio is the relation between current assets and current liabilities. It declined from 0.46 to 0.35 during the period 2004-05 to 2014-15 which implies the decrease in current asset compared to current liabilities. Quick ratio is the relationship between the quick assets and the current liabilities. It declined from 1.44 to -0.71 during the period 2004-05 to 2014-15 which implies a decline in quick assets and it became negative by 2014-15. Cash ratio is the relationship between the cash including bank balance to the current liabilities. It declined from 0.133 to 0.128 during the period from 2004-05 to 2014-15. During 2004-05 to 2014-15, the relative share of receivable against supply of power increased drastically. This is because of the improvements shown by KSEB in collection efficiency.

Fixed assets turnover ratio is defined as the relationship between the sales and the fixed assets. It declined from 0.55 to 0.49 during the period .Current assets turnover ratio is defined as the relationship between sales and current asset. It increased from 1.38 to 5.15 during the period from2004-05 to 2014-15. The financial performance of KSEB is far from satisfaction, which is evident from declining liquidity ratios and activity ratios.

5.2.3 Pricing methods of Electricity Board

Electricity pricing varies widely from country to country and may vary significantly from locality to locality within a particular country. Cost of power supply increased by 37 percent during 2004-05 to 2014-15. The cost of supply of electricity among all categories of consumers except export category also increased during the period from 2004-05 to 2014-15. The highest growth in the cost of supply during the period accounted to the category of ‘Export’ (24.8%) which is followed by the categories, Railway Traction (13.3%) Licensees (7.83%), Commercial (6.88%), Domestic (6.77%) etc... At the same time, growth in total revenue during the same

period outranged the growth in supply cost. The growth in cost of supply was 5.34 percent and that in the revenue was 12.4 percent during the same period.

Tariff rates are fixed by the Kerala State Electricity Regulatory Commission (KSERC).For domestic sector, Telescopic and Non-Telescopic methods are used for billing. BPL consumers with connected load up to 1000 watts and monthly consumption of up to 40 units are charged in the slab rate of Rs. 1.50 per unit. Telescopic tariff is for monthly consumption up to 250 units and non telescopic tariff is for monthly consumption above 250 units.

5.2.4 Household Electricity Consumption

Out of total consumption of electricity in the state almost 49 percentage is being consumed by the household sector. Kerala State Electricity Board has nine licensees across the state and out of these Thrissur Corporation Electricity Department (TECD) is the only one local body to provide electricity for domestic purpose in the state. Out of the 55 wards in Thrissur Corporation, supply of electricity by TCED is almost 58 percent that is in 32 wards and remaining part electricity is supplied by KSEB.

Out of the 300 sample households, 137 (45.7%) households were taken from TCED and 163 (54.3%) households were from KSEB. Majority of the households in both KSEB (51.6%) and TCED (48.4%) are consuming electricity in between 251 units to 500 units in a month. The electricity consumption expenditure of the sample households are associated with the family size, family income and total consumption expenditure.

79.6 percent of TCED and 75.5 percent of KSEB consumers are making their bill payments directly to the office. Most of the consumers (84%) are using electricity for the domestic purpose only while the remaining consumers (16%) are using electricity for household and other purposes including agriculture and business purpose attached with their houses. It is found that monthly electricity bill is significantly associated with purpose of electricity usage.

It is understood that the households are having two types of connections, single phase and three phase. 62 percent of the households have single phase connection and the remaining 38 percent have three phase connection. 67.9 percent of the household with single phase connection use electricity for household purpose and among the households in the category of other uses, 68. 7 percent are having three phase connection. The connection type is significantly associated with the purpose of electricity usage as well as the family income. Majority of the households in both TCED (78.8%) and KSEB (68.7%) are satisfied with the services provided by the authorities.

The regression results shows that 68 percentage of variation in the electricity consumption expenditure of sample households is determined by variation in their total consumption expenditure (R^2 = 0.68) and the total consumption expenditure is highly significant in determining the electricity consumption expenditure. When we compare TCED and KSEB consumers this feature is more significant in the case of TCED consumers. The multiple regression results showed that family size, education status of family head, purpose of electricity usage and family income are more important in determining electricity consumption expenditure of TCED consumers. All the factors except education status of family heads are positively related to the electricity consumption expenditure in the case of both KSEB and TCED consumers. The factors, purpose of electricity usage and family income are more significant among TCED consumers while family size and family income are the most significant factors in determining electricity consumption expenditure among KSEB consumers.

5.2.5 Electricity Conservation Awareness and Practices of Households

Energy conservation means reducing the quantity of energy used for different purpose. The scarcity of electricity leads to the increasing cost and it will affect the domestic consumers to a great extent. At this juncture, it is a necessary to save electricity by adopting conservation practices. It includes switch off bulb/tube when not in use, use of fans at sufficient speed to utility, cleaning bulb/tube periodically etc...

Both KSEB and TCED household consumers have good awareness about the use of CFL and LED lights. It helps to reduce electricity consumption. Both KSEB and TCED household consumers use CFL or LED lights for reducing electricity consumption as per their awareness level about it. In the case of Kitchen Gadgets, KSEB household consumers have more awareness about avoiding frequent closing or opening of refrigerator. The household consumers in TCED have more awareness about the factor 'using energy saving gadgets' in the kitchen .Both KSEB and TCED household consumers have more awareness about putting computers in sleep mode when not in use.

The correlation between awareness and practices of KSEB consumers towards electricity conservation is 0.961 and that of TCED is 0.973.Independent Sample t test was applied to analyse the significant difference between KSEB and TCED household consumers' awareness about electricity conservation and it is found that there is significant difference between KSEB and TCED household consumers with respect to awareness of electricity conservation. TCED household consumers have better awareness than KSEB household consumers about electricity conservation. Independent Sample t test was applied to test the difference between KSEB and TCED consumers in the electricity conservation practices. It is found that, there is a significant difference between KSEB and TCED consumers with respect to electricity conservation. There is significant difference between KSEB and TCED household consumers with respect to awareness of electricity conservation. TCED (68.4) household consumers have better awareness than KSEB household consumers about electricity conservation. Chi- Square test result shows that awareness and practice are significantly associated, when the level of awareness increases, the level of conservation practices increases. Regression analysis was used to test the hypothesis, that Practices of household consumers in KSEB and TCED is not depending on awareness about electricity conservation. The result shows that, there is a significant linear relationship between the variables awareness and practice of household consumers in both KSEB and TCED.

The households could save electricity by using CFL and Star rated appliances. While using CFL in the place of incandescent lamps the TCED consumers could save 3.60 units per household in a day and each KSEB household consumer saved 3.30 units per day. The use of star rating appliances among TCED consumers is more than that among the KSEB consumers. It is found that the TCED consumers could save 236.44 units of electricity per day by using star rating gadgets while the KSEB consumers saved 152.5 units per day.

5.3 Limitations of the study

- Availability of data in KSEB and TCED was major problem faced by the study. They do not have data on many variables or they do not keep them properly. So data collection was very difficult. That is why the study year was limited to 2014 – 15 not the latest.

- Data on profitability is not available with KSEB nor does the board have data on total revenue and total cost so that one could estimate the total profit. Therefore study could not estimate the profitability of KSEB which is a commercial organisation.

- Quantifying subjective variables like satisfaction, awareness etc. was difficult so appropriate methods have to be used for the same. So the study has the inherent limitations of those methods.

5.4 Conclusion

Electricity is an essential resource for developmental activities. When the demand for electricity is increasing along with economic development, supply is also increasing with the implementation of new electricity projects and so the physical performance of State Electricity Board is in improving. But they could not perform well with respect to their financial status. In Kerala, increasing demand for electricity could not be met by the state electricity projects. The KSEB purchases electricity from other states at higher prices to fill the demand- supply gap and it causes an increase in

the financial burden of the board. Since major share of electricity consumption in Kerala is in household sector, tariff restructuring mainly affects households in the state. This critical situation could be overcome by adopting electricity conservation practices or by using renewable sources of energy. The energy saving practices or electricity consumption pattern of the households differ with respect to their socio-economic status and the awareness level of conservation practices. The local authorities can play a key role in regulating the electricity consumption through the adoption of conservation practices. The present study reveals that the conservation equipments used by the consumers could save more electric energy through conservation practices because of their level of awareness.

5.5 Policy Suggestions

The present study highlights the importance of alternative sources of electric energy as an effective solution for energy crisis in the state. The Government should undertake policies to widespread the use of alternative sources, especially among large scale users like agriculture, industry, tourism etc. The role of local Government should be strengthened to diffuse awareness among the consumers on electricity conservation methods and equipments. So polices be framed on focusing the effective involvement of local Governments in this venture.

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Annexure – I

LIST OF ABBREVIATIONS

ARR - Annual Revenue Requirement
CAGR - Compound Annual Growth Rate
CEA – Central Electricity Authority
CGS - Central Generating Stations
CSEZ - Cochin Special Economic Zone
EC - Electricity Consumption
Eff IV - Efficient Instrument Variables
EHT – Extra High Tension
GDP – Gross Domestic Product
GLS – Generalized Least Square
GWh - Giga Watt hour
HT – High Tension
IEA – International Energy Agency
IPP - Independent Power Producer
IRP - Integrated Resource Planning
KSEBL. – Kerala State Electricity Board Ltd.
kV - kilo Watt
kWh – kilo Watt in Hours
LT – Low Tension
MUs – Million Units
MWh - Maga Watt hour
PLF - Plant Load Factor
PPA – Power Purchase Agreement
RTP - Real Time Pricing
SEB - State Electricity Boards
SERC – State Electricity Regulation Commission
T&D - Transmission and Distribution
TCED – Thrissur Corporation Electricity Department
TWh – Tera Watt hour
UT – Union Territory

Annexure – II

HOUSEHOLD ELECTRICITY CONSUMPTION BEHAVIOUR OF KERALA

(A) General Details

1. Place Name :
2. Ward No :
3. Name of the head of household :
4. House number :
5. Study Area : Code: 1- TCED 2-KSEB
6. Type of Area : Code: 1-Rural 2-Urban
7. Religion : Code: 1-H 2- M 3- C 4- Others
8. Social Group : Code: 1-OBC 2-SC 3-ST 4-GEN
9. Nature of the family : Code: 1-Joint 2-Nuclear

10. Household details :

Sl 1	Name 2	Age 3	Gender 4	Marital Status 5	Education Completed 6	Occupation 7	Monthly Income 8	Family Income 9

Code: 4:- 1-male, 2-female. Code: 5:- 1- married, 2-unmarried, 3- widow, 4- divorced. Code:6: 1- Below SSLC, 2-SSLC, 3-PDC, 4- Degree, 5-PG, 6-Diploma, 7-Professional, 9-Others. Code: 7: 1-Agri labour, 2-Industry labour, 3-Businessman, 4-Bank staff, 5-Govt emply, 6-Self emlpy, 7-Unemployed, 9-Others

11. Table about students in the household

. No from Qn.10	Course studying 2	Study Time in min 3	Type of scholar 4	Average study in min 5

Code: 2 is same as code 6. Code: 4: 1-Hostel, 2-Day scholar

(B) Housing Details

1. Ownership of the household ☐

   1-Own 2- Rented 3-Quarter 9-Others

2. If rented / quarters who pays the electricity bill ☐

   1-Self 2- Landlord/ Company

3. Land of house : ☐ in cent
4. Plinth area of House : ☐ in Sq.ft.
5. Type of ration card? ☐ 1-APL, 2-BPL, 3-AAY, 4-No Rc
6. No of rooms in the house (include Hall& kitchen): ☐
7. Type of the house : ☐

   1- Concrete, 2- Tiles, 3- Asbestos, 9- Others (Specify)

8. Source of Drinking Water : ☐

   1-Well, 2- Pipe connection, 3- Public Tap, 9- Others (Specify)

9. Size of Water tank : ☐ in litres
10. Land using for Agriculture purposes : ☐
11. What type of crop cultivate in the household : ☐
12. Motor pump usage in the Agriculture purpose : ☐ Yes – 1 No -2
13. How many hours using per day for Agriculture : ☐ hrs/day
14. Electricity source for Agriculture purpose : ☐

    1- Household connection 2- other connection

15. If other subsidised connection details : ☐

(C) Consumption details

1 Monthly consumption expenditure of the household in Rupees :

2 Expenses on items

Food items	Expense on last month	Non Food items	Expense on last month
Food & beverages		Clothing & foot ware	
Housing		Telephone bill	
		Water charges/annual	

(D) Details on household Electricity consumption

1 Year of Electrification in the house : ☐

2 Connection Type : ☐

1 Single phase 2 Three phase

Previous month	Last month

3 Amount of Electricity bill in last 3 months :

4 Electricity Charge :

5 Electricity Meter reading in Units :

6 Nature of electricity usage : ☐

1- Household purpose only, 2- HH & Agriculture, 3- HH & Business Shops, 4- HH & Industry

7 Details regarding light and Fan

Place of Use	No of Fans	No of tube light			No of incandescent bulbs				Number of CFL / LED			
		20w	40w	other	40w	60w	100w	other	18w	24w	36w	110w

Codes for type of room :- 1 Bed room, 2 Living room, 3 Dining room, 4 Toilet/Bathroom, 5 Corridor, 6 Office room, 7 Kitchen, 8 Outside the house, 9 Others (Specify)

Yes – 1, No – 2

8 Whether electric chock is used for tube light :

9 Whether reflectors are used for CFL/LED bulbs :

10 Type of fan regulator :

Codes: - 1 No regulator, 2 Ordinary regulator

11 Total number of light points in the household :

12 Number of plug points in the household :

13 Is there electric motor pump set used for domestic use :

14 Motor pump set use for domestic purpose :

min/day

15 Whether pump set using starter :

16 Whether there is star labelling /ISI mark on the pump set :

17 Whether motor pump is earthed :

18 Do you use inverter/generator :

min/day

19 If yes, Daily using hours of inverter :

20 If no, Why don't you use inverter :

Code: - 1 Cost, 2 not interested, 3 other energy saver

21 Do you use any special type of lamp :

Code: - 1 Solar, 2 Emergency lamp, 3 Gas lamp, 4 Biogas lamp, 5 others/Specify

22 Type of Appliances used in the households

Sl no	Type of appliances	No of equipments	Watt	Usage in hrs/weekly	Year of purchase
1	Mixer grinder				
2	Mixy				
2	Refrigerator				
3	Motor pump				
4	Iron box				
5	Washing machine				
6	Induction cooker				
7	Chappathi maker				
8	Microwave oven				
9	Emergency Lamp				
10	Air conditioner				
12	Electronic heater				
13	Water cooler				
14	Vacuum cleaner				
15	Electronic Sewing Machine				
16	CD/DVD Player				
17	Television				
18	Computer / Laptop				
19	Others / Specify				

23 Power saving practices in the Household : ☐

Codes: - 1 All members, 2 few members, 3 non

24 Duration of Power failure in min/day : ☐

25 Do you aware of current unit pricing of electricity : ☐

26 When electricity fails source of lighting : ☐

Codes: - 1 Kerosene lamp, 2 Candle, 3 Emergency lamp, 4 inverter, 9 other

27 Purchase of Kerosene from : ☐

Codes: - 1 Ration shop, 2 Private vendors

28 Quantity of kerosene used per month : ☐ in litres

29 Money spent for kerosene per month : ☐ Rs

30 Payment mode of electricity bill : ☐

Code: - 1 Walk in Office KSEB/TCED, 2 Online Payment, 3 Friends, 9 Others

31 Which type of facility using for cooking : ☐

Codes:- 1 firewood, 2 Coconut residue, 3 Rubber residue, 4 Biogas, 5 Kerosene, 6 Saw dust, 7 LPG, 8 Electricity, 9 Others

32 Are you using non-conventional sources for electricity purpose : ☐

Sl no.	Non-Conventional energy sources	Cost	Usage
1.	Solar Energy		
2.	Bio gas for cooking purpose		
3.	Solar heater		
4.	Hot box(KSSP supported model)		

(E) Awareness about Energy saving methods

Code: - 5 – Very high, 4 – High, 3 – Neutral, 2 – Low, 1 – Very Low

1 Switch off bulb / tubes when it's not in use to reduce the electricity consumption

2 Use of CFL/LED lights help me to reduce the electricity consumption

3 Switch off Refrigerator during peak time reduce electricity consumption

4 Knowing that even zero watt bulb consume nearly 15 watt/hrs of electricity

5 Use of renewable/alternative energy source in home to reduce the electricity consumption

6 Careless use of bulb/lights during day time increase the electricity consumption
7 Use of fans set full speed to increase the electricity consumption
8 Avoid frequently closing/opening doors of Refrigerator to reduce the electricity consumption
9 Putting hot dishes and food items into the Refrigerator to increase the electricity consumption
10 Bulk ironing of cloths in my home to reduce my electricity consumption
11 Use of mixer Grander/ wet Grander in overload mode to increase the electricity consumption
12 Using energy saving gadgets in the kitchen like Pressure cooker/hot box to reduce energy consumption
13 Light coloured walls reflect more light and hence minimum lamps are enough to reduce electricity consumption
14 Use of electronic ballasts/ electronic chock against conventional electromagnetic ballasts tube lights for they consume less power
15 Clean bulbs/tube lights and fan leafs periodically to avoid reduction in illumination
16 Use energy efficient star labelled gadgets to reduce energy consumption
17 Use capacitors for water pumps to improve power factor
18 Use solar water heater to reduce electricity consumption
19 Setting computer sleep mode when not in use helps cut energy cost

(F) Practice about Energy Conservation and Improved Technologies

Code:- 5 – Always, 4 – Often, 3 – Sometimes, 2 – Rarely, 1 – Never

1 Switch off bulbs/tubes and other electrical device after use to reduce electricity cost
2 I usually use of CFL/LED lights help me to reduce the cost of electricity
3 I usually switching off Refrigerator during peak time to reduce the electricity charge

4 I reduce the use of Zero watt bulb consume nearly 5 watt of electricity

5 I using that use of renewable/ alternative source in home to reduce my electricity charge

6 I am not making Careless use of bulb/lights during day time to reduce my electricity charge

7 I am using my fans always at a speed sufficient to my utility

8 I Avoid frequently closing/opening doors of Refrigerator to reduce my electricity charge

9 I am not Putting hot dishes and food items into the Refrigerator to reduce my electricity charge

10 I usually iron my cloth in Bulk to enjoy reduce my electricity charge

11 I don't use of mixer Grander/ wet Grander in overload mode

12 I am using energy saving gadgets in the kitchen like Pressure cooker/hot box to reduce energy charge

13 Am using light coloured walls reflect more light and hence minimum lamps are enough to reduce electricity

14 I use of electronic ballasts/ electronic chock in tube light to reduce my electricity charge

15 Maintaining bulbs/tube lights and fan leafs clean properly that wise increase the life of gadgets and reduce electricity charge

16 I use energy efficient star labelled gadgets to reduce electricity charge

17 I use capacitors for water pumps to improve power factor

18 I use solar water heater to reduce additional cost of electricity charge

19 I usually Setting computer sleep mode when not in use helps cut energy cost

1 Do you know about Renewable energy sources? : ☐

2 If yes, what all sources do you know? : ☐

Code: 1-Solar, 2-Biogas, 3-Both, 4-Other

3 Weather any problems faced by using renewable energy sources : ☐

4 Do you have any plan to use renewable resources in the coming years : ☐

5 If yes, which one: 1-Solar , 2-Biogas , 3-Both , 4-Not much : ☐

6 If no, do you plan to use in the future? : ☐

7 Are you a beneficiary from any of the Govt. programme? : ☐

8 Are you ready to accept improved energy saving activities: ☐

9 If yes, how? : ☐

Code: 1- Changing old gadgets to new one, 2- monthly cleaning of the gadgets, 3- Using solar system.

10 Are all members in your family alert about the energy saving practices : ☐

Code: 1- Off light and fan when not in use, 2- off computer when not in use, 3- Off TV when not in use, 4- Mobile phone charger switch off when not in use

11 Service of Electricity department of our location : ☐

Code: Good – 1, Bad – 2, Satisfy – 3 (Q- 29-30)

12 what about your complaints taking approach of the KSEB/TCED : ☐

Annexure – III

KERALA STATE ELECTRICITY BOARD LIMITED
(Incorporated under the Indian Companies Act, 1956)
CIN:U40100KL2011SGC027424
Reg. Office: Vydyuthi Bhavanam, Pattom, Thiruvananthapuram – 695 004
Website: www.kseb.in Phone : +91 471 2514317, 2514617, 2514319,
Fax: +91 471 2448213 E-mail: trac@ksebnet.com

KSEBL/TRAC/Tariff Revision/2017-18/3909 Date: 10.05.2017

CIRCULAR

Sub: Revision of tariff for all categories of consumers with effect from 18.04.2017- orders issued by the Kerala State Electricity Regulatory Commission (KSERC)-directions for implementing the order- reg.

Read: 1. KSERC order No. 1007/F&T/2016/KSERC dated 17.04.2017
2. B.O. (FTD) No.1043/2017(KSEB/TRAC/Tariff Revision/2017-18) dated 21.04.2017

1. Kerala State Electricity Regulatory Commission (KSERC) vide order read above has revised the tariff applicable to certain categories of LT, HT & EHT consumers w.e.f. 18.04.2017. KSERC has also revised the Bulk Supply Tariff (BST) of Licensees in the State w.e.f.18.04.2017.

2. KSERC has also re-categorised certain consumer categories in this tariff order and classification of each consumer category under appropriate tariff category as approved by the KSERC is detailed in the Annexure to the Board order read (2) above .

3. All the distribution field offices shall take due care and attention to raise the invoices to the consumers as per the schedule approved by the KSERC w.e.f. 18.04.2017.

4. KSEB Ltd. vide order read (2) above has ordered to implement the order of the KSERC to revise the tariff revision in the State with effect from 18.04.2017. KSEB Ltd has also decided to continue the present level of subsidy as detailed in the table below, in anticipation of a favourable decision on providing cash subsidy from Govt.of Kerala on account of exemption.

Table-1

Sl.No.	Particulars	Subsidy to be allowed
I.	Domestic Consumers (with monthly consumption upto 120 units)	
1	**Energy charges**	
	(a) Monthly consumption up to 40 units	35 paise / unit
	(b) Monthly consumption from 41 to 120 units	50 paise/ unit
2	Fixed charges	
	(a) Consumers belonging to BPL category with connected load of and below 1000 watts and having bi-monthly consumption up to 80 units	No fixed charge as per order of KSERC
	(b) Other single phase consumers having monthly consumption upto 120 units	Rs 20/ consumer/ month
II	Agriculture consumer {LT- V(A)}	
	Energy charges	85 paise/unit

5. All the section offices shall keep the account of the subsidy provided to consumers as detailed above. All Deputy Chief Engineers, Electrical circles shall compile and communicate the same to the Tariff & Regulatory Affairs Cell (TRAC), on monthly basis on or before 20th of the succeeding month, with a copy to the Financial Advisor. Since the details of the subsidy is a mandatory information to be submitted to the KSERC and Government, any failure from the part of the officers in providing the details to TRAC will be viewed seriously by the KSEB Ltd.

6. Financial Advisor shall initiate necessary action to obtain the subsidy from Government on monthly basis in advance. If subsidy is not received as ordered, the matter shall be immediately brought to the attention of the KSEB Ltd.

7. Electricity duty shall be levied on energy charges payable as per the Kerala Electricity Duty, Act, 1963. Meter rent, low voltage supply surcharge, power factor penalty and other charges ordered by the KSERC from time to time, shall also be levied in addition to the revised electricity charges.

8. All the charges levied on consumers including fixed charges, energy charges, electricity duty, meter rent and any other charges shall be indicated in the invoices.

9. The billing procedure to be followed for implementing the order read above, with effect from 18-04-2017 is appended as **Annexure-1** to this circular for information and strict compliance.

Secretary (Administration)

Encl: As above

To

All Chief Engineers/ Deputy Chief Engineers/Executive Engineers (Ele. Divisions)
The Financial Advisor,
The Chief Internal Auditor
Legal Adviser & Disciplinary Enquiry Officer
T.A to (Chairman & Managing Director)
T.A to Director {Distribution, Safety & Generation (Electrical)}
TA to Director (Trans. & System Operation)
T.A to Director (Corporate Planning & SCM)
T.A to Director (Generation (Civil & HRM)
PA to Director (Finance)/ Sr. CA to Secretary (Administration)
Library

BILLING PROCEDURE FOR THE INTERIM PERIOD (From 18-04-2017 to 15. 06. 2017)

General Instructions and Billing Procedures

(A) General Instructions

1. The revised rate is applicable to all consumers in the State with effect from 18.04.2017 to 31.03.2018 or till further orders.
2. There is no rate revision for the consumers categorized under LT III (A), LT III(B), LT V(A), LTV(B), LTVI(A), LTVI(B), LT VI (C), LT VI (D), LTVI (F), LT VII (A), LTVII(C), LT IX in the present tariff order issued by KSERC
3. There is no rate revision for HT II (B) General, HT III (A) Agriculture, HT III(B) Agriculture, HT IV Commercial, HT V (Domestic) in the High Tension category.
4. There is no rate revision for EHT Industrial (220 kV) , EHT Commercial (66 kV,110 kV,220 kV) & EHT General-B (66 kV,110 kV, 220 kV) { Previously classified as EHT General}
5. KSERC has introduced new tariff category LT VI General (G) for private institutions in health care sector.
6. KSERC has also introduced new tariff category EHT General-A (66 kV,110 kV, 220 kV) mainly for Govt. hospitals& Govt. and aided educational institutions
7. 'LT Domestic consumers having bi-monthly consumption up to 240 units and LT V(A) Agricultural consumers' are exempted from paying the increase in electricity charges (**Bi-monthly consumption upto 80 units -35 paise/units & from 81 units to 240 units-50 paise/unit & for LT Agriculture -85 paise/unit , LT single phase domestic consumers having monthly consumption upto 240 units- fixed charge - Rs.20/month**) effected vide tariff revision order dated 01.07.2012 of KSERC (2012-13 tariff revision only),
8. For subsidized consumers the details of subsidy allowed by the State Government shall be shown invariably in the invoices.
9. The meter rent, low voltage supply surcharge, power factor penalty and other charges, if any shall be collected at the rates approved by KSERC and as per the orders and directions issued by KSEBL from time to time.
10. There is no change in meter rent.
11. There shall be no change in the ToD tariff structure of domestic consumers, LT IV (A) Industry, 'LT IV (B) IT& IT Enabled Industries', HT & EHT consumers.
12. The ruling tariff for ToD billed domestic consumers is Rs.7.50/unit shall prevail for FY 2017-18 also.
13. Cinema theatres under HT & EHT category shall be billed under ToD tariff as per the billing procedure adopted for other ToD billed consumers w.e.f.18.04.2017.
14. There shall be change in existing power factor incentive rates, but there is no change in the power factor penalty rates.

15. There shall be no change in fixed charges for consumer categories other than' LT IV (A) Industry' and 'LT VIII (B) metered street lights and traffic signals'.

16. KSERC has introduced low voltage supply surcharge for consumers having connected load or contract demand above 100 kW/kVA availing supply at LT level.

17. KSERC has also revised Transmission charges, Wheeling charges, cross subsidy surcharge, additional surcharge payable by open access consumers w.e.f.18.04.2017.

(B) Major changes in re-categorization, approved by the State Commission.

Hon'ble Commission has introduced certain categories of consumers in the tariff schedule and categorized /re-categorized some consumer categories. The details of the same are attached under each category.

(C). Billing Procedure for Bi-monthly & monthly billed 'LT' consumers

(I) Domestic consumers (LT- I)

The pre -revised tariff (up to 17.04.2017) and revised tariff applicable to domestic category w.e.f.18.04.2017 is detailed below;

Table-2

Category	PRE-REVISED	REVISED W.E.F.18.04.2017
I. Fixed charge (Rs/ consumer/ month)		
Single phase	20	30
Three phase	60	80
II. Energy Charge (Rs/kWh)		
Monthly consumption slab		
BPL Consumers with connected load up to 1000 watts and monthly consumption up to 40 units		
0-40 units	1.50	1.50
Telescopic tariff for monthly consumption up to 250units		
0-50 units	2.80	2.90
51-100	3.20	3.40
101-150	4.20	4.50
151-200	5.80	6.10
201-250 units	7.00	7.30
Non-telescopic tariff for monthly consumption above 250 units		
0-300 units	5.00	5.50
0-350	5.70	6.20
0-400	6.10	6.50
0-500	6.70	6.70
Above 500 units	7.50	7.50

Note1. Fixed charges shall not be applicable to consumers belonging to below poverty line (BPL) category with connected load of and below 1000 watts and monthly consumption of and below 40 units.

Note 2. The minimum electricity charges payable during the period of disconnection shall be at the following rates:

Single phase – Rs. 30 per consumer per month
Three Phase – Rs. 80 per consumer per month

Note 3. Home stay units approved as such by Department of Tourism shall be billed under LT-I domestic.

Note 4. Domestic consumers shall be allowed to utilize electrical energy in a portion of their residence for their own use for purposes other than domestic if the connected load for the purposes other than for domestic, in their premises does not exceed 20% of the total connected load or 1000 Watts whichever is less. When connected load other than for domestic use in such cases exceeds 20% of the total connected load or 1000 Watts whichever is less, such loads shall be segregated and separate service connection shall be obtained under appropriate tariff. When this is not done, the tariff applicable to the whole service connection shall be at the appropriate tariff applicable to the connected load used for purposes other than domestic, if such tariff is higher than the tariff for LT-I category.

Note.5: (a) The following water supply schemes, solely for domestic purposes shall be charged under domestic tariff.

(i) water supply schemes under Jalanidhi, Jaladhara or Swajaladhara Projects;
(ii) water supply schemes coming under water supply societies or under beneficiary committees;
(iii) water supply schemes for Scheduled Caste (SC) and / or Scheduled Tribe (ST);
(iv) water supply schemes for Laksham Veedu Settlements taken over and managed by Local Self Government Institutions;
(v) social drinking water supply schemes established using local area development funds of Members of Legislative Assembly (MLA) and / or Members of Parliament (MP);
(vi) social drinking water supply schemes established using funds of Local Self Government Institutions;
(vii) social drinking water supply schemes under Peoples Participatory Schemes (PPS);
(viii) Rajeev Gandhi Drinking Water Schemes managed by beneficiary groups.

(b) The method for billing for the above mentioned water supply schemes solely for domestic purpose shall be as specified hereunder;

(c) The total monthly consumption of electricity of the units of such water supply schemes will be divided by the number of beneficiary households and the average consumption per households will be billed under LT – I domestic tariff. The amount of electricity charges assessed for the average consumption per beneficiary household will then be multiplied by the number of beneficiary households to assess the total electricity charges to be paid by the units of such schemes.

(d) Anganwadies, if any, availing drinking water from the above water supply schemes shall also be considered as a beneficiary availing the water supply for domestic purpose and the benefit of such community drinking water schemes shall be extended to them.

Note.6: (a) The tariff for domestic consumption by the families of the victims of endosulfan tragedy in Hosdurg and Kasaragod Taluks of Kasaragod District shall be Rs.1.50 / unit for a monthly consumption up to 150 units. If the consumption of the consumer, who is eligible for the above concession, exceeds 150 units per month, the consumption in excess of 150 units will be charged at the rates specified for the slabs 151-200 units or 201-250 units as the case may be. This concession will not be available for the consumers with monthly consumption above 250 units.

(b) The consumer who is eligible for this concession granted to endosulfan victims has to submit to the officer in charge at the section office of the licensee, a certificate from the revenue authorities or from the local self-government authority to prove his / her eligibility for this tariff concession.

i) **Bi-monthly billed domestic consumers belonging to BPL Category with connected load of and below 1000 watts and bi-monthly consumption up to 80 units (monthly consumption upto 40 units)**

There is no rate revision and hence the invoices for this category shall be issued as per **Annexure-3** and by following existing billing procedure.

ii) **Bi-monthly billed domestic consumers belonging to BPL Category with connected load of and below 1000 watts and having bi-monthly consumption above 80 units**

The procedures prescribed under paragraph-(iii) below for 'Bi-monthly billed domestic consumers having bi-monthly consumption upto 240 units' shall be followed for this category

iii) Bi-monthly billed domestic consumers having bi-monthly consumption upto 240 Units.

Amount payable as per the revised tariff approved by KSERC may be computed as follows.

Step-1: Let 'X' be the bi-monthly consumption as on any billing date from 18.04.2017 to 15.05.2017

Step-2: Compute the energy charge for the consumption 'X' at the Pre-revised rate using **'Annexure-4'** = **'A'**

Step-3: Compute the energy charge at the rate applicable at the revised tariff w.e.f 16.08.2014 using Annexure-4 = 'B'

Step-4: Compute the energy charges payable as on billing date using the multiplication factors 'f1' and 'f2' given under 'Annexure-2'

Energy charge payable as on billing date 'E'= ('A' x 'f1') + ('B' x 'f2')

Step-5: Fixed charge payable as per the order of KSERC

For single phase, F_s (bimonthly billed) = (40Xf1+60xf2)
For three phase, F_t (bimonthly billed) = (120Xf1+160xf2)
For single phase, F_s (monthly billed) = (20Xf1+30xf2)
For three phase, F_t (monthly billed) = (60Xf1+80xf2)
(Factors from Annexure-2)

Step-6: Take the meter rent as ordered by KSERC (R_M)

Step-7 : Subsidy provided by the Government

(a) Subsidy on Energy charge (using Annexure-4) = 'C'

(b) Subsidy on Fixed charge 'S_F'

For single phase, FC_s (for two months), S_F = 40
For three phase, FC_t (for two months) = 0

(c) Total subsidy = 'S' = 'C' + 'S_F'

Step-8: Compute the electricity on energy charge as per Kerala Electricity Duty Act, 1963

Step-9: Prepare the invoice as detailed below:

Table-3

Sl No	Particulars	Amount (Rs.)
1	Energy charges payable at the revised rates approved by KSERC 'E' (Step-4)	####
2	Fixed charges at the rate approved by KSERC 'Fs' or 'F_t' (Step-5)	####
3	Subsidy provided by Government 'S'(Step-7)	####
4	Electricity duty (as per schedule- of the KED Act-1963)](10% of the net energy charges	####
5	Meter rent (MR)	####
6	Other Charges (OC)	####
7	Net amount payable= (1)+(2)+(4)+(5)+(6)-(3)	####

iv) ***Bi-monthly billed domestic consumers having bi-monthly consumption above 240 units.***

There is no subsidy to this consumer group and hence electricity charges shall be computed by following the steps1 to 9 in para (iii) above except **step-7 (subsidy computation)** and by using Annexure-5.

v) **ToD Tariff for Domestic Consumers having monthly consumption above 500 units.**

i) **Energy Charge:**

a) ToD tariff is applicable Domestic consumers **(three phase only)** who consume more than 500 Units per month. KSERC has not revised the energy charge for the consumption above 400 units /month. Also KSERC has not revised the ToD tariff structure and billing procedure for this consumer group. Hence energy charges shall be computed as usual, based on the prevailing ruling tariff and billing procedure.

b) Ruling energy tariff = Rs.7.50/unit (non-telescopic rate for monthly consumption above 500 units)

c) ToD tariff structure :

Table - 4

Monthly Consumption	Normal Period (6 hrs to 18 hrs)	Peak Period (18 hrs to 22 hrs)	Off Peak Period (22hrs to 06 hrs)
above 500 Units	100% of the ruling tariff	120% of the ruling tariff	90% of the ruling tariff

d) Fixed Charge: KSERC has revised the fixed charge applicable to domestic consumers and hence the fixed charge payable shall be computed as follows:

For three phase, FC_t (monthly billed) = (60 x f1) + (80 x f2)
For three phase, FC_t (bimonthly billed) = (120 X f2) + (160xf2)
(Factors from Annexure-2)

vi) **Water supply schemes solely for domestic purpose**

a) KSERC has recategorised this consumer group from LT VI General (E) to LT- I domestic.

b) The pre-revised and revised charge is tabled below:

Table-5

Pre revised and revised tariff applicable for drinking water supply schemes

Monthly Fixed Charges: (Rs. per consumer)	**Pre-revised Tariff{LT VI(E)}**		**Revised Tariff w.e.f 18.04.2017{LT –I}**	
Single phase	20		30	
Three phase	60		80	
Energy Charge (Rs./kwh)				
Monthly consumption slab	**Pre-revised Tariff**		**Revised Tariff w.e.f 18.04.2017**	
1 to 50 units	2.80	Non-telescopic	2.90	Telescopic
51 to 100 units	3.80		3.40	
101 to 150units	4.50		4.50	
151 to 200 units			6.10	
201 to 250 units	6.30		7.30	

c) Fixed charge payable as per the order of KSERC

For single phase, F_s (bimonthly billed) = (40xf1) + (60xf2)
For three phase, F_t (bimonthly billed) = (120 x f1) + (160 x f2)
For single phase, F_s (monthly billed) = (20 x f1) +30 x f2)
For three phase, F_t (monthly billed) = (60 x f1) +(80 xf2)

(Factors from Annexure-2)

d) Energy charge

i) bi-monthly /monthly consumption as on billing date. =X

ii) Total No. of beneficiaries = Y

iii) Compute the average consumption of each beneficiary (Z) = $\frac{X}{Y}$

iv) Calculate the energy charge at the pre-revised rate {LTVI (E)} for Z units, **A** = 'Z' x pre-revised energy rate as per the **table -5** above

v) Compute the energy charge at the rate applicable at the revised tariff(for 'Z' units) w.e.f 18.04.2017 **using Annexure-4** = 'B'

vi) Compute the energy charges payable as on billing date using the multiplication factors 'f1' and 'f2' given under **'Annexure-2'**,

Energy charge for 'z" units as on billing date 'E'= ('A' x 'f1') +('B' x 'f2')

vii) Total Energy charge 'F' = 'E' x 'Y'

e) Meter rent (MR) and electricity duty (ED) shall be levied as per the prevailing procedure.

f) There is **no subsidy on energy charge and fixed charge** for this consumer group.

vii) **Endosulphan victims:**

a) Fixed charge

For single phase, F_s (bimonthly billed) = (40xf1) + (60xf2)
For three phase, F_t (bimonthly billed) = (120 x f1) + (160 x f2)
For single phase, F_s (monthly billed) = (20 x f1) +30 x f2)
For three phase, F_t (monthly billed) = (60 x f1) + (80 xf2)

(Factors from Annexure-2)

b) Energy Charge:

i) Energy Charge for bi-monthly consumption upto 300 units = Rs.1.50/unit
from 301units to 400 units = Rs.6.10/unit
from 401units to 500 units = Rs.7.30/unit

E) Billing Procedure for 'EHT' consumers

1. EHT Industrial (66 kV)

i) The pre-revised and revised tariff for EHT Industrial (66 kV) w.e.f. 18.04.2017 is detailed below.

Table-29

Particulars	Pre revised Tariff	Revised Tariff wef 18.04.2017
Demand charge (Rs/ kVA /month)	300	300
Energy Charge (Rs. per unit)	**4.90**	**5.20**

a) Let consumption upto 17.04.2017 = X_1
(as per the cut-off reading taken on 18.04.2017)

b) Let consumption for the remaining period of April 2017 = X_2
(as per the final reading taken for the month of April-2017)

c) Compute the Energy charge at the 'pre- revised tariff' **(Rs.4.90/unit) for consumption 'X_1'** for consumption 'as per the procedure followed till 17.04.2017'.

Let it be 'ECa'.

d) Compute the Energy charge at the revised tariff' **(Rs.5.20/unit) for consumption 'X_2'** as per the procedure followed till 17.04.2017.

Let it be 'EC_b'

e) Total Energy charge (EC) = 'EC_a'+ 'EC_b'

v) take the meter rent (if any) and compute the electricity duty as usual.

vi) other charges (power factor incentive), if any, as ordered by KSERC shall also levied

2. EHT Industrial (110 kV)

i) The pre-revised and revised tariff for EHT Industrial (110 kV) w.e.f. 18.04.2017 is detailed below.

Table-30

Particulars	Pre revised Tariff	Revised Tariff w.e.f 18.04.2017
Demand charge (Rs/ kVA per month)	290	290
Energy Charge (Rs. per unit)	**4.80**	**5.10**

ii) The electricity charges for this category for the month of April-2017 shall be raised by following the procedure laid down for **EHT Industrial (66 kV),** except with changes in the energy charges (Rs.4.80 -pre-revised & Rs.5.10 – revised)

3. EHT GENERAL- A (66 kV, 110 kV, 220kV)

i) This tariff is applicable to consumers enumerated under LT VI (A) category availing supply at EHT.

ii) The pre-revised and revised tariff w.e.f. 18.04.2017 is detailed below.

Table-31

Particulars		Pre revised Tariff {EHT General}	Revised Tariff w.e.f 18.04.2017 {EHT GENERAL (A)}
Demand charge (Rs/ kVA per month)		370	300
Energy Charge (Rs. per unit)	Of and below 60000 units (all units)	5.80	5.00
	above 60000 units (all units)	6.80	

iii) There shall be no change in the ToD tariff structure (**energy charge- normal -100% of the ruling rate, peak -150% of the ruling rate, off-peak 75% of the ruling rate**) and billing procedure for consumers categorized under this category.

iv) Compute the Demand charge including excess demand charge and energy charge at the 'pre- revised tariff' **(Rs.370/kVA / month)** as per the procedure followed till 17.04.2017

Let it be 'TDC1'.

v) Compute the Demand charge including excess demand charge and energy charge at the revised tariff' **(Rs.300/kVA / month)** as per the procedure followed till 17.04.2017

Let it be 'TDC2'.

vi) Demand charge ='TDC' = 'TDC1' x (17/30)+ 'TDC2' x (13/30)

vii) Energy charge:

a) Let consumption upto 17.04.2017 = X_1
(as per the cut-off reading taken on 18.04.2017)

b) Let consumption for the remaining period of April 2017 = X_2
(as per the final reading taken for the month of April-2017)

c) Compute the Energy charge at the 'pre- revised tariff' **(Rs.5.80/unit upto 60000 units & for above 60000 units Rs. 6.80 as the case may be) for consumption 'X_1'**) as per the procedure followed till 17.04.2017.Let it be 'ECa'.

d) Compute the Energy charge at the revised tariff' **(Rs.5.00/unit) for consumption 'X_2' as** per the procedure followed till 17.04.2017.

Let it be 'EC_b'

viii) Total Energy charge (EC) = 'EC_a'+ 'EC_b'

ix) Total Demand charge = 'TDC'

x) take the meter rent (if any) and compute the electricity duty as usual.

xi) other charges (power factor incentive), if any, as ordered by KSERC shall also levied, from time to time.

4. EHT GENERAL B (66 kV, 110 kV, 220kV)

This tariff category is applicable to Indian Space Research Organization (ISRO) Airport, Self Financing Educational Institutions and other EHT consumers not included elsewhere. The consumers erstwhile classified under EHT General is now re-classified under this category {except consumers categorized under LT VI (A)}

Table-32

EHT General -B (66KV,110 KV,220 KV)	
Particulars	**Approved Tariff w.e.f 18.04.2017**
Demand charge (Rs/ kVA per month)	370
Energy Charge (Rs. per unit)	
Monthly consumption Upto 60,000 units	5.80
Monthly consumption Above 60,000 units	6.80

5) Railway Traction

i) The pre-revised and revised tariff for 'Railway Traction' w.e.f. 18.04.2017 is detailed below.

Table-33

Particulars	Pre revised Tariff	Revised Tariff w.e.f.18.04.2017
Demand charge (Rs/ kVA per month)	250	250
Energy Charge (Rs. per unit)	4.80	5.10

ii) Railways shall not be billed on ToD tariff.

iii) The revision is for energy charge only.

iv) The electricity charges for this category for the month of April-2017 shall be raised by following the procedure laid down for **EHT Industrial (66 kV)** by incorporating changes in the energy charge rates (Rs.4.80 -pre-revised & Rs.5.10 – revised)

6) Kochi Metro Rail Corporation Ltd. (KMRL)

I) The tariff applicable for KMRL is tabled below:

Table-34

KMRL (110 kV)	
Particulars	**Tariff w.e.f. 18.04.2017**
Demand charge (Rs/ kVA per month)	250
Energy Charge (Rs. per unit)	4.80

Table-35

Major changes in the categorization of EHT consumers

Sl. No.	Particulars	Pre revised Tariff category (prior to 18.04.2017)	Revised tariff category (w.e.f. 18.04.2017)	Remarks
1	Kochin Metro Rail Corporation Ltd.		KMRL (110 Kv	Newly introduced
2	Consumers categorised under LT VI General (A) availing supply at Extra high tension	EHT GENERAL	Extra High tension - II GENERAL (A) {EHT-General (A)}	Newly introduced
3	ISRO ,Airport, Self Financing educational institutions and consumers not included in any other EHT Category	EHT GENERAL	Extra High tension - II GENERAL (B) {EHT-General (B)}	Re-named the category

Note: Revised electricity charges due to recategorisation of any category shall be computed on pro rata basis (ie. pre- revised charges for 17 days and revised charges for 13 days).

F. Bulk Supply Tariff (BST)

i) BST for the FY 2017-18 applicable to Licensees w.e.f. 18.04.2017 to 31.03.2018

Table-36

Sl No	Licensee	Pre revised Tariff		Revised Tariff w.e.f.18.04.2017	
		Demand charge (Rs/ kVA/ month)	Energy charge (Rs/ kWh)	Demand charge (Rs/ kVA/ month)	Energy charge (Rs/ kWh)
1	KPUPL	300	5.30	300	5.60
2	CSEZ	300	5.30	300	5.40
3	RPL	300	4.55	300	4.55
4	Technopark	300	4.85	300	5.20
5	CPT	300	5.75	300	6.00
6	Thrissur	300	5.40	300	5.85
7	KDHPCL	300	4.30	300	4.60
8	MES	350	5.10	350	5.60
9	Pudusserry	350	5.10	350	5.60
10	Karnataka	350	5.10	350	5.60
11	Infopark	300	5.55	300	5.50

ii) There shall not be any change in the demand charge applicable to Licensees.

iii) The electricity charges for this category for the month of April-2017 shall be raised based on the cut off reading taken on 18.04.2017 by following the procedure laid down for **EHT Industrial (66 kV)** by incorporating changes in the energy charge rates

G. Transmission charges and wheeling charges payable by open access consumers

i) The pre-revised and revised charges applicable w.e.f. 18.04.2017 is listed below:

Table-37

Particulars	Pre-revised rate (Rs / kWh)	Revised rate with effect from 18.04.2017
Transmission charges	0.26	0.37 /unit for short term collective transactions
		Rs 8580 MW/day for short term consumers of the transmission system other than short term transaction through power exchanges
Wheeling charges	0.32	0.31/unit

H. Cross subsidy surcharge payable by open access consumers

i) The pre-revised and revised charges applicable w.e.f. 18.04.2017 is listed below:

Table-38

Particulars	At the pre-revised tariff (Rs/unit)	At the revised tariff (Rs/unit)	
		Embedded consumers	Non Embedded consumers
EHT- 66 kV	0	1.04	1.14
EHT- 110 kV	0	1.02	1.16
EHT- 220 kV	0	0.63	1.34
EHT General	1.8	1.26	1.62
Railways	0	0	0
HT-1 (A)Industrial	0	0.91	1.28
HT-1 (B)Industrial	0.5	1.16	1.33
HT-II General(A)	0.1	0.81	1.38
HT-II General(B)	1.8	1.34	1.66
HT-III Agriculture(A)	0	0	0.16
HT-III Agriculture (B)	0	0	0
HT-IV commercial	2.3	1.36	1.8
HT-V Domestic	0	0.91	1.53

I. Low Voltage Surcharge

The consumers who are required to avail supply at HT as per the Regulation 8 of the Kerala Electricity Supply Code, 2014, but availing supply at LT, shall pay the low voltage surcharge as specified below.

Low voltage surcharge for consumers having connected load/ contract demand above 100 kW/kVA and availing supply at LT level w.e.f.18.04.2017

1. Consumers without demand based metering and having connected load above 100 kW shall be levied with low voltage supply surcharge.
2. Consumers with demand based metering having Contract demand above 100 kVA shall also be levied with low voltage supply surcharge.
3. The consumer has to pay the demand charge/fixed charge at LT level.
4. The consumer is also liable to pay the low voltage supply surcharge as detailed below in addition to the fixed charge /demand change at LT level

Table-39

Particulars	Low voltage surcharge
Consumers listed under LT-IV (A) category	Rs 150/kVA/month
Consumers listed under LT-IV (B) category	Rs 175/kVA/month
Consumers listed under LT-VI(A) category	Rs 268/kW/month
Consumers listed under LT-VI(B) category	Rs 248/kW/month
Consumers listed under LT-VI(F) category	Rs 243/kW/month
Consumers listed under LT-VII (A) category	Rs 243/kW/month
Consumers listed under LT-VII(C) category	Rs 273/kW/month

5. Low voltage supply surcharge is effective from 18.04.2017 and hence the same shall be levied on a pro- rata basis for the month of April-2017.
6. Separate account shall be kept for levy and collection of low voltage supply surcharge.
7. For consumer categories not mentioned in the Table -39 above following formulae can be adopted for arriving low voltage supply surcharge.

Low voltage supply surcharge connected load based billing consumers = (Demand charge at HT level x 0.9) – (Fixed charge at LT level)

Low voltage supply surcharge **for demand based billing consumers** = Difference in demand charge between HT & LT level

J) **Power factor incentive / disincentive**

The following incentive and disincentive shall be applicable to LT industrial consumers with a connected load of and above 20 kW, HT&EHT Consumers for power factor improvement.

Power factor range	**Incentive**
Power factor between 0.9 to 1.00	**0.50%** of energy charges for each 0.01 unit increase in power factor from 0.9
Power factor range	**Disincentive**
Power factor below 0.90	1% energy charge for every 0.01 fall in power factor from 0.90

i) KSERC has revised the power factor incentive from 0.25% to 0.5% w.e.f.18.04.2017.

ii) There shall not be any change in the dis-incentive (penalty) rates.

ii) Power factor incentive charges for the month of April -2017 shall be levied on pro-rata basis.ie 0.25 % upto 17.04.2017 & thereafter 0.50%

K) There shall not be any change in the following:-

(1) Meter Rent of all types of energy meters

(2) Optional demand tariff (applicable to Optional Scheme for LT VI General (A), LT VI General (B), LT VI General (C), LT VI General (E), LT VI General (F), LT VI General (G), LT-VII Commercial (A) and LT VII Commercial (C) having connected load equal or above 20 kW.

(3) Values of Static capacitors to be provided for power factor improvement..

Multiplication Factors

Table-1

Multiplication Factor (f1)

Billing date	Factor 'f1'	Billing date	Factor 'f1'
18 April-17	0.983	18-May-17	0.483
19 April-17	0.967	19-May-17	0.467
20 April-17	0.950	20-May-17	0.450
21 April-17	0.933	21-May-17	0.433
22 April-17	0.917	22-May-17	0.417
23 April-17	0.900	23-May-17	0.400
24 April-17	0.883	24-May-17	0.383
25 April-17	0.867	25-May-17	0.367
26 April-17	0.850	26-May-17	0.350
27 April-17	0.833	27-May-17	0.333
28 April-17	0.817	28-May-17	0.317
29 April-17	0.800	29-May-17	0.300
30 April-17	0.783	30-May-17	0.283
01 May 17	0.767	31-May-17	0.267
02 May 17	0.750	01-June-17	0.250
03 May 17	0.733	02-June-17	0.233
04 May 17	0.717	03-June-17	0.217
05 May 17	0.700	04-June-17	0.200
06 May 17	0.683	05-June-17	0.183
07 May 17	0.667	06-June-17	0.167
08 May 17	0.650	07-June-17	0.150
09 May 17	0.633	08-June-17	0.133
10 May 17	0.617	09-June-17	0.117
11 May 17	0.600	10-June-17	0.100
12 May 17	0.583	11-June-17	0.083
13 May 17	0.567	12-June-17	0.067
14 May 17	0.550	13-June-17	0.050
15 May 17	0.533	14-June-17	0.033
16 May 17	0.517	15-June-17	0.017
17 May 17	0.500	16-June-17	0.000

Table-2

Multiplication Factor (f2)

Billing date	Factor 'f2'	Billing date	Factor 'f2'
18 April-17	0.017	18-May-17	0.517
19 April-17	0.033	19-May-17	0.533
20 April-17	0.050	20-May-17	0.550
21 April-17	0.067	21-May-17	0.567
22 April-17	0.083	22-May-17	0.583
23 April-17	0.100	23-May-17	0.600
24 April-17	0.117	24-May-17	0.617
25 April-17	0.133	25-May-17	0.633
26 April-17	0.150	26-May-17	0.650
27 April-17	0.167	27-May-17	0.667
28 April-17	0.183	28-May-17	0.683
29 April-17	0.200	29-May-17	0.700
30 April-17	0.217	30-May-17	0.717
01 May 17	0.233	31-May-17	0.733
02 May 17	0.250	01-June-17	0.750
03 May 17	0.267	02-June-17	0.767
04 May 17	0.283	03-June-17	0.783
05 May 17	0.300	04-June-17	0.800
06 May 17	0.317	05-June-17	0.817
07 May 17	0.333	06-June-17	0.833
08 May 17	0.350	07-June-17	0.850
09 May 17	0.367	08-June-17	0.867
10 May 17	0.383	09-June-17	0.883
11 May 17	0.400	10-June-17	0.900
12 May 17	0.417	11-June-17	0.917
13 May 17	0.433	12-June-17	0.933
14 May 17	0.450	13-June-17	0.950
15 May 17	0.467	14-June-17	0.967
16 May 17	0.483	15-June-17	0.983
17 May 17	0.500	16-June-17	1.00

READY RECKONER- FOR LT - I BI-MONTHLY CONSUMPTION UP TO 80 UNITS w.e.f. 18.04.2017 (BPL CATEGORY CONSUMERS HAVING CONNECTED LOAD OF AND BELOW 1000 WATTS)

Bi-monthly consumption (in units)	Energy charge (Rs) (B)		Bi-monthly consumption (in units)	Energy charge (Rs) (B)
1	1.50		41	61.50
2	3.00		42	63.00
3	4.50		43	64.50
4	6.00		44	66.00
5	7.50		45	67.50
6	9.00		46	69.00
7	10.50		47	70.50
8	12.00		48	72.00
9	13.50		49	73.50
10	15.00		50	75.00
11	16.50		51	76.50
12	18.00		52	78.00
13	19.50		53	79.50
14	21.00		54	81.00
15	22.50		55	82.50
16	24.00		56	84.00
17	25.50		57	85.50
18	27.00		58	87.00
19	28.50		59	88.50
20	30.00		60	90.00
21	31.50		61	91.50
22	33.00		62	93.00
23	34.50		63	94.50
24	36.00		64	96.00
25	37.50		65	97.50
26	39.00		66	99.00
27	40.50		67	100.50
28	42.00		68	102.00
29	43.50		69	103.50
30	45.00		70	105.00
31	46.50		71	106.50
32	48.00		72	108.00
33	49.50		73	109.50
34	51.00		74	111.00
35	52.50		75	112.50
36	54.00		76	114.00
37	55.50		77	115.50
38	57.00		78	117.00
39	58.50		79	118.50
40	60.00		80	120.00

KSERC has not revised the tariff applicable to domestic consumers belonging to BPL category with connected load of and below 1000 Watts and having bi-monthly consumption up to 80 units.

READY RECKONER- for LT - I (Bi-monthly Consumption Upto 240 units w.e.f.18.04.2017)

Bi-monthly consumption	Energy charges		Subsidy
	pre-revised rate	revised rate	
	(Rs)	(Rs)	(Rs)
	(A)	(B)	(C)
1	2.80	2.90	0.35
2	5.60	5.80	0.70
3	8.40	8.70	1.05
4	11.20	11.60	1.40
5	14.00	14.50	1.75
6	16.80	17.40	2.10
7	19.60	20.30	2.45
8	22.40	23.20	2.80
9	25.20	26.10	3.15
10	28.00	29.00	3.50
11	30.80	31.90	3.85
12	33.60	34.80	4.20
13	36.40	37.70	4.55
14	39.20	40.60	4.90
15	42.00	43.50	5.25
16	44.80	46.40	5.60
17	47.60	49.30	5.95
18	50.40	52.20	6.30
19	53.20	55.10	6.65
20	56.00	58.00	7.00
21	58.80	60.90	7.35
22	61.60	63.80	7.70
23	64.40	66.70	8.05
24	67.20	69.60	8.40
25	70.00	72.50	8.75
26	72.80	75.40	9.10
27	75.60	78.30	9.45
28	78.40	81.20	9.80
29	81.20	84.10	10.15
30	84.00	87.00	10.50
31	86.80	89.90	10.85
32	89.60	92.80	11.20
33	92.40	95.70	11.55
34	95.20	98.60	11.90
35	98.00	101.50	12.25
36	100.80	104.40	12.60
37	103.60	107.30	12.95
38	106.40	110.20	13.30
39	109.20	113.10	13.65
40	112.00	116.00	14.00
41	114.80	118.90	14.35
42	117.60	121.80	14.70
43	120.40	124.70	15.05
44	123.20	127.60	15.40
45	126.00	130.50	15.75
46	128.80	133.40	16.10
47	131.60	136.30	16.45
48	134.40	139.20	16.80
49	137.20	142.10	17.15
50	140.00	145.00	17.50

Bi-monthly consumption	Energy charges		
	pre-revised rate	revised rate	Subsidy
	(Rs)	(Rs)	(Rs)
	(A)	(B)	(C)
51	142.80	147.90	17.85
52	145.60	150.80	18.20
53	148.40	153.70	18.55
54	151.20	156.60	18.90
55	154.00	159.50	19.25
56	156.80	162.40	19.60
57	159.60	165.30	19.95
58	162.40	168.20	20.30
59	165.20	171.10	20.65
60	168.00	174.00	21.00
61	170.80	176.90	21.35
62	173.60	179.80	21.70
63	176.40	182.70	22.05
64	179.20	185.60	22.40
65	182.00	188.50	22.75
66	184.80	191.40	23.10
67	187.60	194.30	23.45
68	190.40	197.20	23.80
69	193.20	200.10	24.15
70	196.00	203.00	24.50
71	198.80	205.90	24.85
72	201.60	208.80	25.20
73	204.40	211.70	25.55
74	207.20	214.60	25.90
75	210.00	217.50	26.25
76	212.80	220.40	26.60
77	215.60	223.30	26.95
78	218.40	226.20	27.30
79	221.20	229.10	27.65
80	224.00	232.00	28.00
81	226.80	234.90	28.50
82	229.60	237.80	29.00
83	232.40	240.70	29.50
84	235.20	243.60	30.00
85	238.00	246.50	30.50
86	240.80	249.40	31.00
87	243.60	252.30	31.50
88	246.40	255.20	32.00
89	249.20	258.10	32.50
90	252.00	261.00	33.00
91	254.80	263.90	33.50
92	257.60	266.80	34.00
93	260.40	269.70	34.50
94	263.20	272.60	35.00
95	266.00	275.50	35.50
96	268.80	278.40	36.00
97	271.60	281.30	36.50
98	274.40	284.20	37.00
99	277.20	287.10	37.50
100	280.00	290.00	38.00

Bi-monthly consumption	Energy charges		Subsidy
	pre-revised rate	revised rate	
	(Rs)	(Rs)	(Rs)
	(A)	(B)	(C)
101	283.20	293.40	38.50
102	286.40	296.80	39.00
103	289.60	300.20	39.50
104	292.80	303.60	40.00
105	296.00	307.00	40.50
106	299.20	310.40	41.00
107	302.40	313.80	41.50
108	305.60	317.20	42.00
109	308.80	320.60	42.50
110	312.00	324.00	43.00
111	315.20	327.40	43.50
112	318.40	330.80	44.00
113	321.60	334.20	44.50
114	324.80	337.60	45.00
115	328.00	341.00	45.50
116	331.20	344.40	46.00
117	334.40	347.80	46.50
118	337.60	351.20	47.00
119	340.80	354.60	47.50
120	344.00	358.00	48.00
121	347.20	361.40	48.50
122	350.40	364.80	49.00
123	353.60	368.20	49.50
124	356.80	371.60	50.00
125	360.00	375.00	50.50
126	363.20	378.40	51.00
127	366.40	381.80	51.50
128	369.60	385.20	52.00
129	372.80	388.60	52.50
130	376.00	392.00	53.00
131	379.20	395.40	53.50
132	382.40	398.80	54.00
133	385.60	402.20	54.50
134	388.80	405.60	55.00
135	392.00	409.00	55.50
136	395.20	412.40	56.00
137	398.40	415.80	56.50
138	401.60	419.20	57.00
139	404.80	422.60	57.50
140	408.00	426.00	58.00
141	411.20	429.40	58.50
142	414.40	432.80	59.00
143	417.60	436.20	59.50
144	420.80	439.60	60.00
145	424.00	443.00	60.50
146	427.20	446.40	61.00
147	430.40	449.80	61.50
148	433.60	453.20	62.00
149	436.80	456.60	62.50
150	440.00	460.00	63.00

READY RECKONER- for LT - I (Bi-monthly Consumption Upto 240 units w.e.f.18.04.2017)

Bi-monthly consumption	Energy charges		Subsidy
	pre-revised rate	revised rate	
	(Rs)	(Rs)	(Rs)
	(A)	(B)	(C)
151	443.20	463.40	63.50
152	446.40	466.80	64.00
153	449.60	470.20	64.50
154	452.80	473.60	65.00
155	456.00	477.00	65.50
156	459.20	480.40	66.00
157	462.40	483.80	66.50
158	465.60	487.20	67.00
159	468.80	490.60	67.50
160	472.00	494.00	68.00
161	475.20	497.40	68.50
162	478.40	500.80	69.00
163	481.60	504.20	69.50
164	484.80	507.60	70.00
165	488.00	511.00	70.50
166	491.20	514.40	71.00
167	494.40	517.80	71.50
168	497.60	521.20	72.00
169	500.80	524.60	72.50
170	504.00	528.00	73.00
171	507.20	531.40	73.50
172	510.40	534.80	74.00
173	513.60	538.20	74.50
174	516.80	541.60	75.00
175	520.00	545.00	75.50
176	523.20	548.40	76.00
177	526.40	551.80	76.50
178	529.60	555.20	77.00
179	532.80	558.60	77.50
180	536.00	562.00	78.00
181	539.20	565.40	78.50
182	542.40	568.80	79.00
183	545.60	572.20	79.50
184	548.80	575.60	80.00
185	552.00	579.00	80.50
186	555.20	582.40	81.00
187	558.40	585.80	81.50
188	561.60	589.20	82.00
189	564.80	592.60	82.50
190	568.00	596.00	83.00
191	571.20	599.40	83.50
192	574.40	602.80	84.00
193	577.60	606.20	84.50
194	580.80	609.60	85.00
195	584.00	613.00	85.50
196	587.20	616.40	86.00
197	590.40	619.80	86.50
198	593.60	623.20	87.00
199	596.80	626.60	87.50
200	600.00	630.00	88.00

Bi-monthly consumption	Energy charges		Subsidy
	pre-revised rate	revised rate	
	(Rs)	(Rs)	(Rs)
	(A)	(B)	(C)
201	604.20	634.50	88.50
202	608.40	639.00	89.00
203	612.60	643.50	89.50
204	616.80	648.00	90.00
205	621.00	652.50	90.50
206	625.20	657.00	91.00
207	629.40	661.50	91.50
208	633.60	666.00	92.00
209	637.80	670.50	92.50
210	642.00	675.00	93.00
211	646.20	679.50	93.50
212	650.40	684.00	94.00
213	654.60	688.50	94.50
214	658.80	693.00	95.00
215	663.00	697.50	95.50
216	667.20	702.00	96.00
217	671.40	706.50	96.50
218	675.60	711.00	97.00
219	679.80	715.50	97.50
220	684.00	720.00	98.00
221	688.20	724.50	98.50
222	692.40	729.00	99.00
223	696.60	733.50	99.50
224	700.80	738.00	100.00
225	705.00	742.50	100.50
226	709.20	747.00	101.00
227	713.40	751.50	101.50
228	717.60	756.00	102.00
229	721.80	760.50	102.50
230	726.00	765.00	103.00
231	730.20	769.50	103.50
232	734.40	774.00	104.00
233	738.60	778.50	104.50
234	742.80	783.00	105.00
235	747.00	787.50	105.50
236	751.20	792.00	106.00
237	755.40	796.50	106.50
238	759.60	801.00	107.00
239	763.80	805.50	107.50
240	768.00	810.00	108.00

READY RECKONER- for LT - I (Bi-monthly Consumption above 240 units w.e.f.18.04.2017

Bi-monthly consumption	Energy charges	
	pre-revised rate	revised rate
	(Rs)	(Rs)
	(A)	(B)
241	772.20	814.50
242	776.40	819.00
243	780.60	823.50
244	784.80	828.00
245	789.00	832.50
246	793.20	837.00
247	797.40	841.50
248	801.60	846.00
249	805.80	850.50
250	810.00	855.00
251	814.20	859.50
252	818.40	864.00
253	822.60	868.50
254	826.80	873.00
255	831.00	877.50
256	835.20	882.00
257	839.40	886.50
258	843.60	891.00
259	847.80	895.50
260	852.00	900.00
261	856.20	904.50
262	860.40	909.00
263	864.60	913.50
264	868.80	918.00
265	873.00	922.50
266	877.20	927.00
267	881.40	931.50
268	885.60	936.00
269	889.80	940.50
270	894.00	945.00
271	898.20	949.50
272	902.40	954.00
273	906.60	958.50
274	910.80	963.00
275	915.00	967.50
276	919.20	972.00
277	923.40	976.50
278	927.60	981.00
279	931.80	985.50
280	936.00	990.00
281	940.20	994.50
282	944.40	999.00
283	948.60	1003.50
284	952.80	1008.00
285	957.00	1012.50
286	961.20	1017.00
287	965.40	1021.50
288	969.60	1026.00
289	973.80	1030.50
290	978.00	1035.00

Bi-monthly consumption	Energy charges	
	pre-revised rate	revised rate
	(Rs)	(Rs)
	(A)	(B)
291	982.20	1039.50
292	986.40	1044.00
293	990.60	1048.50
294	994.80	1053.00
295	999.00	1057.50
296	1003.20	1062.00
297	1007.40	1066.50
298	1011.60	1071.00
299	1015.80	1075.50
300	1020.00	1080.00
301	1025.80	1086.10
302	1031.60	1092.20
303	1037.40	1098.30
304	1043.20	1104.40
305	1049.00	1110.50
306	1054.80	1116.60
307	1060.60	1122.70
308	1066.40	1128.80
309	1072.20	1134.90
310	1078.00	1141.00
311	1083.80	1147.10
312	1089.60	1153.20
313	1095.40	1159.30
314	1101.20	1165.40
315	1107.00	1171.50
316	1112.80	1177.60
317	1118.60	1183.70
318	1124.40	1189.80
319	1130.20	1195.90
320	1136.00	1202.00
321	1141.80	1208.10
322	1147.60	1214.20
323	1153.40	1220.30
324	1159.20	1226.40
325	1165.00	1232.50
326	1170.80	1238.60
327	1176.60	1244.70
328	1182.40	1250.80
329	1188.20	1256.90
330	1194.00	1263.00
331	1199.80	1269.10
332	1205.60	1275.20
333	1211.40	1281.30
334	1217.20	1287.40
335	1223.00	1293.50
336	1228.80	1299.60
337	1234.60	1305.70
338	1240.40	1311.80
339	1246.20	1317.90
340	1252.00	1324.00

Bi-monthly consumption	Energy charges	
	pre-revised rate	revised rate
	(Rs)	(Rs)
	(A)	(B)
341	1257.80	1330.10
342	1263.60	1336.20
343	1269.40	1342.30
344	1275.20	1348.40
345	1281.00	1354.50
346	1286.80	1360.60
347	1292.60	1366.70
348	1298.40	1372.80
349	1304.20	1378.90
350	1310.00	1385.00
351	1315.80	1391.10
352	1321.60	1397.20
353	1327.40	1403.30
354	1333.20	1409.40
355	1339.00	1415.50
356	1344.80	1421.60
357	1350.60	1427.70
358	1356.40	1433.80
359	1362.20	1439.90
360	1368.00	1446.00
361	1373.80	1452.10
362	1379.60	1458.20
363	1385.40	1464.30
364	1391.20	1470.40
365	1397.00	1476.50
366	1402.80	1482.60
367	1408.60	1488.70
368	1414.40	1494.80
369	1420.20	1500.90
370	1426.00	1507.00
371	1431.80	1513.10
372	1437.60	1519.20
373	1443.40	1525.30
374	1449.20	1531.40
375	1455.00	1537.50
376	1460.80	1543.60
377	1466.60	1549.70
378	1472.40	1555.80
379	1478.20	1561.90
380	1484.00	1568.00
381	1489.80	1574.10
382	1495.60	1580.20
383	1501.40	1586.30
384	1507.20	1592.40
385	1513.00	1598.50
386	1518.80	1604.60
387	1524.60	1610.70
388	1530.40	1616.80
389	1536.20	1622.90
390	1542.00	1629.00

READY RECKONER- for LT - I (Bi-monthly Consumption above 240 units w.e.f.18.04.2017)

Bi-monthly consumption	Energy charges	
	pre-revised rate	revised rate
	(Rs)	(Rs)
	(A)	(B)
391	1547.80	1635.10
392	1553.60	1641.20
393	1559.40	1647.30
394	1565.20	1653.40
395	1571.00	1659.50
396	1576.80	1665.60
397	1582.60	1671.70
398	1588.40	1677.80
399	1594.20	1683.90
400	1600.00	1690.00
401	1607.00	1697.30
402	1614.00	1704.60
403	1621.00	1711.90
404	1628.00	1719.20
405	1635.00	1726.50
406	1642.00	1733.80
407	1649.00	1741.10
408	1656.00	1748.40
409	1663.00	1755.70
410	1670.00	1763.00
411	1677.00	1770.30
412	1684.00	1777.60
413	1691.00	1784.90
414	1698.00	1792.20
415	1705.00	1799.50
416	1712.00	1806.80
417	1719.00	1814.10
418	1726.00	1821.40
419	1733.00	1828.70
420	1740.00	1836.00
421	1747.00	1843.30
422	1754.00	1850.60
423	1761.00	1857.90
424	1768.00	1865.20
425	1775.00	1872.50
426	1782.00	1879.80
427	1789.00	1887.10
428	1796.00	1894.40
429	1803.00	1901.70
430	1810.00	1909.00
431	1817.00	1916.30
432	1824.00	1923.60
433	1831.00	1930.90
434	1838.00	1938.20
435	1845.00	1945.50
436	1852.00	1952.80
437	1859.00	1960.10
438	1866.00	1967.40
439	1873.00	1974.70
440	1880.00	1982.00

Bi-monthly consumption	Energy charges	
	pre-revised rate	revised rate
	(Rs)	(Rs)
	(A)	(B)
441	1887.00	1989.30
442	1894.00	1996.60
443	1901.00	2003.90
444	1908.00	2011.20
445	1915.00	2018.50
446	1922.00	2025.80
447	1929.00	2033.10
448	1936.00	2040.40
449	1943.00	2047.70
450	1950.00	2055.00
451	1957.00	2062.30
452	1964.00	2069.60
453	1971.00	2076.90
454	1978.00	2084.20
455	1985.00	2091.50
456	1992.00	2098.80
457	1999.00	2106.10
458	2006.00	2113.40
459	2013.00	2120.70
460	2020.00	2128.00
461	2027.00	2135.30
462	2034.00	2142.60
463	2041.00	2149.90
464	2048.00	2157.20
465	2055.00	2164.50
466	2062.00	2171.80
467	2069.00	2179.10
468	2076.00	2186.40
469	2083.00	2193.70
470	2090.00	2201.00
471	2097.00	2208.30
472	2104.00	2215.60
473	2111.00	2222.90
474	2118.00	2230.20
475	2125.00	2237.50
476	2132.00	2244.80
477	2139.00	2252.10
478	2146.00	2259.40
479	2153.00	2266.70
480	2160.00	2274.00
481	2167.00	2281.30
482	2174.00	2288.60
483	2181.00	2295.90
484	2188.00	2303.20
485	2195.00	2310.50
486	2202.00	2317.80
487	2209.00	2325.10
488	2216.00	2332.40
489	2223.00	2339.70
490	2230.00	2347.00

Bi-monthly consumption	Energy charges	
	pre-revised rate	revised rate
	(Rs)	(Rs)
	(A)	(B)
491	2237.00	2354.30
492	2244.00	2361.60
493	2251.00	2368.90
494	2258.00	2376.20
495	2265.00	2383.50
496	2272.00	2390.80
497	2279.00	2398.10
498	2286.00	2405.40
499	2293.00	2412.70
500	2300.00	2420.00
501	2505.00	2755.50
502	2510.00	2761.00
503	2515.00	2766.50
504	2520.00	2772.00
505	2525.00	2777.50
506	2530.00	2783.00
507	2535.00	2788.50
508	2540.00	2794.00
509	2545.00	2799.50
510	2550.00	2805.00
511	2555.00	2810.50
512	2560.00	2816.00
513	2565.00	2821.50
514	2570.00	2827.00
515	2575.00	2832.50
516	2580.00	2838.00
517	2585.00	2843.50
518	2590.00	2849.00
519	2595.00	2854.50
520	2600.00	2860.00
521	2605.00	2865.50
522	2610.00	2871.00
523	2615.00	2876.50
524	2620.00	2882.00
525	2625.00	2887.50
526	2630.00	2893.00
527	2635.00	2898.50
528	2640.00	2904.00
529	2645.00	2909.50
530	2650.00	2915.00
531	2655.00	2920.50
532	2660.00	2926.00
533	2665.00	2931.50
534	2670.00	2937.00
535	2675.00	2942.50
536	2680.00	2948.00
537	2685.00	2953.50
538	2690.00	2959.00
539	2695.00	2964.50
540	2700.00	2970.00

READY RECKONER- for LT - I (Bi-monthly Consumption above 240 units w.e.f.18.04.2017)

Bi-monthly consumption	Energy charges	
	pre-revised rate	revised rate
	(Rs)	(Rs)
	(A)	(B)
541	2705.00	2975.50
542	2710.00	2981.00
543	2715.00	2986.50
544	2720.00	2992.00
545	2725.00	2997.50
546	2730.00	3003.00
547	2735.00	3008.50
548	2740.00	3014.00
549	2745.00	3019.50
550	2750.00	3025.00
551	2755.00	3030.50
552	2760.00	3036.00
553	2765.00	3041.50
554	2770.00	3047.00
555	2775.00	3052.50
556	2780.00	3058.00
557	2785.00	3063.50
558	2790.00	3069.00
559	2795.00	3074.50
560	2800.00	3080.00
561	2805.00	3085.50
562	2810.00	3091.00
563	2815.00	3096.50
564	2820.00	3102.00
565	2825.00	3107.50
566	2830.00	3113.00
567	2835.00	3118.50
568	2840.00	3124.00
569	2845.00	3129.50
570	2850.00	3135.00
571	2855.00	3140.50
572	2860.00	3146.00
573	2865.00	3151.50
574	2870.00	3157.00
575	2875.00	3162.50
576	2880.00	3168.00
577	2885.00	3173.50
578	2890.00	3179.00
579	2895.00	3184.50
580	2900.00	3190.00
581	2905.00	3195.50
582	2910.00	3201.00
583	2915.00	3206.50
584	2920.00	3212.00
585	2925.00	3217.50
586	2930.00	3223.00
587	2935.00	3228.50
588	2940.00	3234.00
589	2945.00	3239.50
590	2950.00	3245.00

Bi-monthly consumption	Energy charges	
	pre-revised rate	revised rate
	(Rs)	(Rs)
	(A)	(B)
591	2955.00	3250.50
592	2960.00	3256.00
593	2965.00	3261.50
594	2970.00	3267.00
595	2975.00	3272.50
596	2980.00	3278.00
597	2985.00	3283.50
598	2990.00	3289.00
599	2995.00	3294.50
600	3000.00	3300.00
601	3425.70	3726.20
602	3431.40	3732.40
603	3437.10	3738.60
604	3442.80	3744.80
605	3448.50	3751.00
606	3454.20	3757.20
607	3459.90	3763.40
608	3465.60	3769.60
609	3471.30	3775.80
610	3477.00	3782.00
611	3482.70	3788.20
612	3488.40	3794.40
613	3494.10	3800.60
614	3499.80	3806.80
615	3505.50	3813.00
616	3511.20	3819.20
617	3516.90	3825.40
618	3522.60	3831.60
619	3528.30	3837.80
620	3534.00	3844.00
621	3539.70	3850.20
622	3545.40	3856.40
623	3551.10	3862.60
624	3556.80	3868.80
625	3562.50	3875.00
626	3568.20	3881.20
627	3573.90	3887.40
628	3579.60	3893.60
629	3585.30	3899.80
630	3591.00	3906.00
631	3596.70	3912.20
632	3602.40	3918.40
633	3608.10	3924.60
634	3613.80	3930.80
635	3619.50	3937.00
636	3625.20	3943.20
637	3630.90	3949.40
638	3636.60	3955.60
639	3642.30	3961.80
640	3648.00	3968.00

Bi-monthly consumption	Energy charges	
	pre-revised rate	revised rate
	(Rs)	(Rs)
	(A)	(B)
641	3653.70	3974.20
642	3659.40	3980.40
643	3665.10	3986.60
644	3670.80	3992.80
645	3676.50	3999.00
646	3682.20	4005.20
647	3687.90	4011.40
648	3693.60	4017.60
649	3699.30	4023.80
650	3705.00	4030.00
651	3710.70	4036.20
652	3716.40	4042.40
653	3722.10	4048.60
654	3727.80	4054.80
655	3733.50	4061.00
656	3739.20	4067.20
657	3744.90	4073.40
658	3750.60	4079.60
659	3756.30	4085.80
660	3762.00	4092.00
661	3767.70	4098.20
662	3773.40	4104.40
663	3779.10	4110.60
664	3784.80	4116.80
665	3790.50	4123.00
666	3796.20	4129.20
667	3801.90	4135.40
668	3807.60	4141.60
669	3813.30	4147.80
670	3819.00	4154.00
671	3824.70	4160.20
672	3830.40	4166.40
673	3836.10	4172.60
674	3841.80	4178.80
675	3847.50	4185.00
676	3853.20	4191.20
677	3858.90	4197.40
678	3864.60	4203.60
679	3870.30	4209.80
680	3876.00	4216.00
681	3881.70	4222.20
682	3887.40	4228.40
683	3893.10	4234.60
684	3898.80	4240.80
685	3904.50	4247.00
686	3910.20	4253.20
687	3915.90	4259.40
688	3921.60	4265.60
689	3927.30	4271.80
690	3933.00	4278.00

READY RECKONER- for LT - I (Bi-monthly Consumption above 240 units w.e.f.18.04.2017)

Bi-monthly consumption	Energy charges	
	pre-revised rate	revised rate
	(Rs)	(Rs)
	(A)	(B)
691	3938.70	4284.20
692	3944.40	4290.40
693	3950.10	4296.60
694	3955.80	4302.80
695	3961.50	4309.00
696	3967.20	4315.20
697	3972.90	4321.40
698	3978.60	4327.60
699	3984.30	4333.80
700	3990.00	4340.00
701	4276.10	4556.50
702	4282.20	4563.00
703	4288.30	4569.50
704	4294.40	4576.00
705	4300.50	4582.50
706	4306.60	4589.00
707	4312.70	4595.50
708	4318.80	4602.00
709	4324.90	4608.50
710	4331.00	4615.00
711	4337.10	4621.50
712	4343.20	4628.00
713	4349.30	4634.50
714	4355.40	4641.00
715	4361.50	4647.50
716	4367.60	4654.00
717	4373.70	4660.50
718	4379.80	4667.00
719	4385.90	4673.50
720	4392.00	4680.00
721	4398.10	4686.50
722	4404.20	4693.00
723	4410.30	4699.50
724	4416.40	4706.00
725	4422.50	4712.50
726	4428.60	4719.00
727	4434.70	4725.50
728	4440.80	4732.00
729	4446.90	4738.50
730	4453.00	4745.00
731	4459.10	4751.50
732	4465.20	4758.00
733	4471.30	4764.50
734	4477.40	4771.00
735	4483.50	4777.50
736	4489.60	4784.00
737	4495.70	4790.50
738	4501.80	4797.00
739	4507.90	4803.50
740	4514.00	4810.00

Bi-monthly consumption	Energy charges	
	pre-revised rate	revised rate
	(Rs)	(Rs)
	(A)	(B)
741	4520.10	4816.50
742	4526.20	4823.00
743	4532.30	4829.50
744	4538.40	4836.00
745	4544.50	4842.50
746	4550.60	4849.00
747	4556.70	4855.50
748	4562.80	4862.00
749	4568.90	4868.50
750	4575.00	4875.00
751	4581.10	4881.50
752	4587.20	4888.00
753	4593.30	4894.50
754	4599.40	4901.00
755	4605.50	4907.50
756	4611.60	4914.00
757	4617.70	4920.50
758	4623.80	4927.00
759	4629.90	4933.50
760	4636.00	4940.00
761	4642.10	4946.50
762	4648.20	4953.00
763	4654.30	4959.50
764	4660.40	4966.00
765	4666.50	4972.50
766	4672.60	4979.00
767	4678.70	4985.50
768	4684.80	4992.00
769	4690.90	4998.50
770	4697.00	5005.00
771	4703.10	5011.50
772	4709.20	5018.00
773	4715.30	5024.50
774	4721.40	5031.00
775	4727.50	5037.50
776	4733.60	5044.00
777	4739.70	5050.50
778	4745.80	5057.00
779	4751.90	5063.50
780	4758.00	5070.00
781	4764.10	5076.50
782	4770.20	5083.00
783	4776.30	5089.50
784	4782.40	5096.00
785	4788.50	5102.50
786	4794.60	5109.00
787	4800.70	5115.50
788	4806.80	5122.00
789	4812.90	5128.50
790	4819.00	5135.00

Bi-monthly consumption	Energy charges	
	pre-revised rate	revised rate
	(Rs)	(Rs)
	(A)	(B)
791	4825.10	5141.50
792	4831.20	5148.00
793	4837.30	5154.50
794	4843.40	5161.00
795	4849.50	5167.50
796	4855.60	5174.00
797	4861.70	5180.50
798	4867.80	5187.00
799	4873.90	5193.50
800	4880.00	5200.00

READY RECKONER- for LT - I (Bi-monthly Consumption above 240 units w.e.f.18.04.2017)

Bi-monthly consumption	Energy charges No rate revision (Rs) (A)
801	5366.70
802	5373.40
803	5380.10
804	5386.80
805	5393.50
806	5400.20
807	5406.90
808	5413.60
809	5420.30
810	5427.00
811	5433.70
812	5440.40
813	5447.10
814	5453.80
815	5460.50
816	5467.20
817	5473.90
818	5480.60
819	5487.30
820	5494.00
821	5500.70
822	5507.40
823	5514.10
824	5520.80
825	5527.50
826	5534.20
827	5540.90
828	5547.60
829	5554.30
830	5561.00
831	5567.70
832	5574.40
833	5581.10
834	5587.80
835	5594.50
836	5601.20
837	5607.90
838	5614.60
839	5621.30
840	5628.00
841	5634.70
842	5641.40
843	5648.10
844	5654.80
845	5661.50
846	5668.20
847	5674.90
848	5681.60
849	5688.30
850	5695.00

Bi-monthly consumption	Energy charges No rate revision (Rs) (A)
851	5701.70
852	5708.40
853	5715.10
854	5721.80
855	5728.50
856	5735.20
857	5741.90
858	5748.60
859	5755.30
860	5762.00
861	5768.70
862	5775.40
863	5782.10
864	5788.80
865	5795.50
866	5802.20
867	5808.90
868	5815.60
869	5822.30
870	5829.00
871	5835.70
872	5842.40
873	5849.10
874	5855.80
875	5862.50
876	5869.20
877	5875.90
878	5882.60
879	5889.30
880	5896.00
881	5902.70
882	5909.40
883	5916.10
884	5922.80
885	5929.50
886	5936.20
887	5942.90
888	5949.60
889	5956.30
890	5963.00
891	5969.70
892	5976.40
893	5983.10
894	5989.80
895	5996.50
896	6003.20
897	6009.90
898	6016.60
899	6023.30
900	6030.00

Bi-monthly consumption	Energy charges No rate revision (Rs) (A)
901	6036.70
902	6043.40
903	6050.10
904	6056.80
905	6063.50
906	6070.20
907	6076.90
908	6083.60
909	6090.30
910	6097.00
911	6103.70
912	6110.40
913	6117.10
914	6123.80
915	6130.50
916	6137.20
917	6143.90
918	6150.60
919	6157.30
920	6164.00
921	6170.70
922	6177.40
923	6184.10
924	6190.80
925	6197.50
926	6204.20
927	6210.90
928	6217.60
929	6224.30
930	6231.00
931	6237.70
932	6244.40
933	6251.10
934	6257.80
935	6264.50
936	6271.20
937	6277.90
938	6284.60
939	6291.30
940	6298.00
941	6304.70
942	6311.40
943	6318.10
944	6324.80
945	6331.50
946	6338.20
947	6344.90
948	6351.60
949	6358.30
950	6365.00

READY RECKONER- for LT - I (Bi-monthly consumption above 240 units w.e.f. 18.04.2017)

Bi-monthly consumption	Energy charges No rate revision (Rs) (A)
951	6371.70
952	6378.40
953	6385.10
954	6391.80
955	6398.50
956	6405.20
957	6411.90
958	6418.60
959	6425.30
960	6432.00
961	6438.70
962	6445.40
963	6452.10
964	6458.80
965	6465.50
966	6472.20
967	6478.90
968	6485.60
969	6492.30
970	6499.00
971	6505.70
972	6512.40
973	6519.10
974	6525.80
975	6532.50
976	6539.20
977	6545.90
978	6552.60
979	6559.30
980	6566.00
981	6572.70
982	6579.40
983	6586.10
984	6592.80
985	6599.50
986	6606.20
987	6612.90
988	6619.60
989	6626.30
990	6633.00
991	6639.70
992	6646.40
993	6653.10
994	6659.80
995	6666.50
996	6673.20
997	6679.90
998	6686.60
999	6693.30
1000	6700.00

Bi-monthly consumption	Energy charges No rate revision (Rs) (A)
1001	7507.50
1002	7515.00
1003	7522.50
1004	7530.00
1005	7537.50
1006	7545.00
1007	7552.50
1008	7560.00
1009	7567.50
1010	7575.00
1011	7582.50
1012	7590.00
1013	7597.50
1014	7605.00
1015	7612.50
1016	7620.00
1017	7627.50
1018	7635.00
1019	7642.50
1020	7650.00
1021	7657.50
1022	7665.00
1023	7672.50
1024	7680.00
1025	7687.50
1026	7695.00
1027	7702.50
1028	7710.00
1029	7717.50
1030	7725.00
1031	7732.50
1032	7740.00
1033	7747.50
1034	7755.00
1035	7762.50
1036	7770.00
1037	7777.50
1038	7785.00
1039	7792.50
1040	7800.00
1041	7807.50
1042	7815.00
1043	7822.50
1044	7830.00
1045	7837.50
1046	7845.00
1047	7852.50
1048	7860.00
1049	7867.50
1050	7875.00

Annexure – IV

Thrissur Municipal Corporation