

## CHAPTER 7

### ENERGY DEVELOPMENT

Energy is an essential input for economic development and improving the quality of life. Development of conventional forms of energy for meeting the growing needs of society at a reasonable cost is the responsibility of the Government and promotion of non-conventional /alternative/ new and renewable sources of energy such as solar, wind and bio energy etc are getting sustained attention. Nuclear energy development being geared up to contribute significantly to the overall energy availability in the country.

#### **Power**

7.1 Power development in India commenced at the end of the 19<sup>th</sup> century with the commissioning of electricity supply in Dargeeling during 1897, followed by the commissioning of a hydropower station at Sivasamudram in Karnataka during 1902. In the pre-independence era, the power supply was mainly in the private sector and that too was limited to the urban areas. With the formation of State Electricity Boards during Five Year Plans, significant step was taken in bringing about a systematic growth of power supply industry all over the country. A number of multipurpose projects came in to being and with the setting up of thermal, hydro and nuclear power station, power generation stations increased significantly.

7.2 The Ministry of Power is primarily responsible for the development of electrical energy in the country. The Ministry is concerned with perspective planning, policy formulation, processing of projects for investment decisions, monitoring of the implementation of power projects, training and manpower development and the administration and enactment of legislation with regard to thermal and hydro power generation, transmission and distribution. In all technical matters, the Ministry of Power is assisted by the Central Electricity Authority (CEA)

7.3 Energy is truly most indispensable growth factor to the world's economy and human well being. Indian energy growth projections have also been caught in the supply sided consumption obsessed frames and needs rationalization serious equity issues also exist with wide gaps between per capita consumption levels between metros and rural areas across the states. In the process of emerging energy as an economic giant, India is facing the critical challenge of meeting a fast increasing demand for energy. As the economy is on the growth path, the demand for energy over next two decades will increase considerably. Due to the fast-paced growth of India's economy, the country's energy demand has grown an average of 3.6 % per annum over the past 30 years. In November 2010, the installed power generation capacity of India stood at 1, 67,077.36 MW and percapita power consumption stood at 612kwh.

#### **Power for ALL**

7.4 The Government of India has an ambitious mission of Power for All by 2012. This mission would require that the installed generation capacity should be at least 2, 00,000 MW

by 2012 from the present level of 1, 67,077.36 MW of power as on November 30, 2010. Power requirement will double by 2020 to 4, 00,000 MW.

## Installed Power Generation in India

7.5 Power sector witnessed severe fluctuations in progress in 2010 in terms of capacity addition. The country hopes to achieve 78000 MW in the generation capacity in the five years ending 2012. The country produces 167077.36 MW of power as on November 30, 2010, but nothing can illustrate the slack pace of capacity addition. The total demand for electricity in India is expected to cross 950000 MW by 2030. So far, between 2007-08 and 2008-09, about 12000 MW of capacity has been added and another 66000 MW is in various stages of the pipeline. Most of these projects are funded and managed by private parties. About 65 % of the electricity consumed in India is generated by thermal power plants, 25 % by hydro electric power plants and 3 % by nuclear power plants and 7 % by renewable sources. India was one of the pioneering countries in establishing hydroelectric power plants.

7.6 However, the sector continues to be ridden with some fundamental problems. Slack capacity addition continues to be a serious worry as it may jeopardize infrastructure as well as economic growth. The growth in Electricity Generation during 2009-10 was constrained due to unsatisfactory performance of some of the new thermal generating units commissioned during 2007-08 and 2009-10, delay in commissioning of new units during 2009-10, long outages, shortage of coal / gas / nuclear fuel, poor hydrology etc.

7.7 As on November 30, 2010, position of All India Installed Capacity can be seen in the Table 7. 1.

**Table 7.1**  
**Total Installed Capacity in India as on 30.11.2010**

Fuel	MW	(Percentage)
Thermal	108362.98	64.6
Hydro	37367.40	24.7
Nuclear	4560.00	2.9
Renewable Sources	16786.98	7.8
<b>Total</b>	<b>167077.36</b>	<b>100</b>

*Source: Ministry of Power, Govt of India*

7.8 The installed power generation in the country has increased from 156092.23 MW as on 31.12.2009 to 167077.36 MW as on 30.11.2010. The capacity addition was 10985.13 MW. Out of the total installed capacity of 167077.36 MW, a major chunk of the energy generation comes from thermal energy (64.6%). It was estimated as 108362.98 M.W. It was followed by hydro 37367.40 MW (24.7%), nuclear 4560 MW (2.9%) and 16786.98 MW (7.85) of renewable sources. The percentage of increase in installed capacity from 2009 to 2010 was 7.04 %. Contribution of each sector to the national grid as on 30.11.2010 is shown in the table 7.2.

**Table 7.2**  
**Sectoral Contribution as on 30.11.2010**

Sector	MW	(Percentage)
State Sector	82026.05	52.5
Central Sector	51867.63	34.0
Private Sector	33183.68	13.5
<b>Total</b>	<b>167077.36</b>	<b>100.00</b>

*Source: Ministry of Power, Govt of India*

## Power for the Poor

7.9 Several State Governments in India provide electricity at subsidized rates or even free to some sections. This includes for use in agriculture and for consumption by backward classes. The subsidies are mainly as cross-subsidization, with the other users such as industries and private consumers paying the deficit caused by the subsidized charges collected. Such measures have resulted in many of the State Electricity Boards becoming financially weak.

7.10 At present (2009), the price per unit of electricity in India is about ` 4 (8 US cents) for domestic consumers and ` 9 for the commercial supply. The Ministry of India has so far provided support for coverage of around 9300 villages and hamlets in 25 States under electricity to the poor. The programme is expected to cover 10000 remote unelectrified villages and hamlets and benefit around 1 million households. Availability of lighting/ basic electricity to the remote villages and hamlets is expected to improve the quality of life of the people, including better health and education.

### **Kerala's Power Sector Projections**

7.11 In the past, the energy demand was presumed to be basis with load factor being used to convert the projected energy demand to peak MW demand. The projected energy demand was worked out by a combination of end use and time series analysis. This was the methodology used in the Electric Power Surveys (EPS) conducted by CEA in conjunction with the State Electricity Boards.

7.12 One of the problems with the above approach has been the consistent over projection of peak demand. The annual growth of peak power demand has been assumed to be of the order of 7-8% and this has resulted in projections well beyond actual demands realised.

7.13 Some of these anomalies have been corrected in the current EPS conducted and the projections for Kerala as continued in the 17<sup>th</sup> Draft EPS. The figures for Kerala in terms of demand projection in the Draft 17<sup>th</sup> EPS are given below.

**Table 7.3**  
**17<sup>th</sup> EP S Estimates for 11<sup>th</sup> Plan period**

<b>Year</b>	<b>Energy Consumption</b>	<b>Peak Demanded</b>	<b>Annual Load Factor (%)</b>
2006-07	11147	2699	60.75
2007-08	12037	2823	61.54
2008-09	12973	2947	62.34
2009-10	13977	3078	63.14
2010-11	15112	3227	63.94
2011-12	16345	3391`	64.74

*Source: EPS Draft report*

7.14 As can be seen from 17<sup>th</sup> EPS Draft Report, there are a number of assumptions, which may result in the actual demand being more than what is being projected in the EPS or being less. KSEB's own projections taking into account a higher growth rate and a slightly lower load factor projects the following demands for the 11<sup>th</sup> plan period.

**Table 7.4**  
**KSEB's projections for the 11<sup>th</sup> Plan Period**

<b>Year</b>	<b>Energy Consumption</b>	<b>Peak Demand</b>	<b>Annual Load Factor (%)</b>
2007-08	15217	2856	60.82
2008-09	16096	3004	61.17
2009-10	17025	3159	61.52
2010-11	18077	3335	61.87
2011-12	19230	3528	62.22

*Source: EPS Draft report*

## Power Sector in Kerala

7.15 Power Sector in Kerala plays a vital role in all developmental activities in Kerala. Obviously power crisis is the Prime Obstacle to start new initiatives in the industrial field. The need for power is increasing and the production of power should also increase accordingly. Monsoon is essential to sustain the hydropower base in the state and the shortage in rainfall usually creates power crisis. Kerala received abundant monsoon during the current year and it increased the inflow in to KSEB reservoirs; the KSEB could manage the power supply situation with higher quantum of cheaper hydel power. Kerala is one among the very few states in the country where there was no load shedding and power cut during 2009-10. 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 domestic as well as 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.

### Box.1

#### Energy Security in the Kerala Context

Energy Security is a rather complex concept covering various aspects like access, distribution of energy supplies across countries and associated vulnerabilities, reliabilities and resilience of energy services and affordability. Energy security is defined as “assured and sustainable access to clean energy of desired quantity and quality at affordable rates to everyone in the society”.

The availability of clean fuel for cooking was another energy security concern raised. Census of India, 2001 shows that 67% of Kerala household uses a combination of fuel wood and gas for cooking. The remaining 33% use only fuel wood for cooking.

The third aspect of energy security is the issue of demand and supply balance in the Power sector. Looking at the current scenario of demand and supply balance in the state to understand and see how the situation would transform in the immediate future would be useful in this regard.

## Generation

7.16 The history of Hydro Power development in Kerala begins with the commissioning of Pallivasal Hydro Electric Project in 1940. Next few decades reflected the progressive developments of various hydroelectric schemes implemented in the state. Sabarigiri in 1966 and Idukki in 1976 are milestones of Kerala State Electricity Board.

7.17 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 2011. 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.

## Capacity Addition during 2009-10

7.18 Power System in Kerala encompasses hydel, thermal and wind sources. Hydel energy is the most reliable and dependable source in Kerala. Of the total installed capacity, 2746.19 MW, the lion's share of 1933 MW of installed capacity comes from 24 hydel stations; 783.11

MW is contributed by the thermal projects including NTPC at Kayamkulam which is Kerala's dedicated thermal station. Kanjikode wind farm, Palakkad has an installed capacity of 2.03 MW. Wind Energy from IPP is 28.05 MW. Capacity addition during 2009-10 was only 51.44 MW (1.9 %) to 2746.19 MW as on 31-3-2010 from 2694.75 MW on 31-3-2009. The table (7.5) depicts detail of energy source and its installed capacity in Kerala as on 31-3-2010.

**Table 7.5**  
**Energy Source in Kerala as on 31-3-2010**

Sl. No.	Source of Energy	Installed Capacity (MW)
1	Hydel – KSEB	1893.00
2	Thermal : KSEB	234.60
3	Wind : KSEB	2.03
4	NTPC	359.58
5	Thermal : IPP	188.93
6	Hydel : Captive	33.00
7	Hydel: IPP	7.00
8	Wind: IPP	28.05
	<b>Total</b>	<b>2746.19</b>

Source: KSEB

7.19 Total Installed Capacity in Kerala as on 31.03.2010 as shown in the table 7.6 given below.

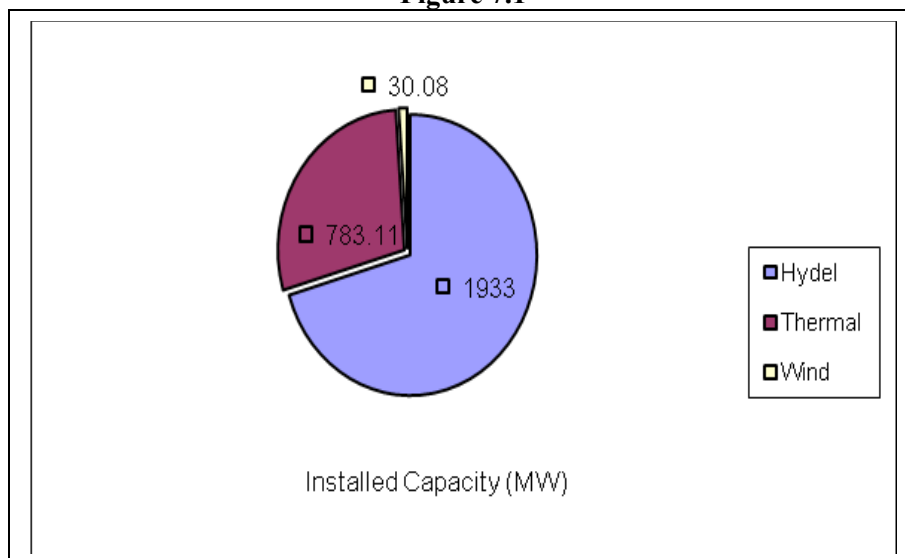
**Table 7.6**  
**Sectorwise Installed Capacity in Kerala as on 31.03.2010**

Sector	MW	Percentage
State Sector	2129.63	77.55
Central Sector	359.58	13.09
Private Sector	256.98	9.36
Total	2746.19	100

Source: KSEB

7.20 Figure 7.1 highlights total installed capacity in Kerala from hydel, thermal and wind sources.

**Figure 7.1**



7.21 Under the purview of KSEB, 18 hydel projects are in the pipeline. The details of the project can be seen in the Table 7.7

### Hydel Generation

7.22 During the year 2009-10, Kerala received abundant inflow into KSEB reservoirs. During this period the peak demand reached 2998 MW. On account of various factors like the reduction in inflow, disaster at Sabarigiri Power house, shut down of Panniar Power house, high cost of naphtha and LSHS during the beginning of the year, reduction in availability of CGS etc, there was huge gap in the availability against the requirement.

**Table 7.7**  
**Projects in the Pipeline**

Sl. No.	Name of the Project	Installed capacity (MW)	Energy Potential (MU)
1	Pallivasal Extension	60	153.90
2	Adyanpara	3.50	9.01
3	Athirappally	163.00	233.00
4	Sengulam Augmentation	-	85.00
5	Sengulam Tailrace	3.60	12.57
6	Chathankottunada II	6.00	14.76
7	Poozhithode	4.80	10.97
8	Vilangad	7.50	22.63
9	Thottiar	40.00	99.00
10	Mangulam	40.00	82.00
11	Pasukkadavu	2.00	5.36
12	Maniyar tailrace (Ranni- Perinad)	4.00	16.73
13	Perumthenaruvi	6.00	25.77
14	Chimony	2.50	6.03
15	Peechi	1.50	3.30
16	Barapole	21.00	51.00
17	Achankovil	30.00	75.81
18	Chinnar	24.00	78.00

Source: KSEB

### Availability of Negative Surplus Power during 2009-10

7.23 With the hike in the consumption of energy, the State's power quota from the central pool has suddenly shrunk from 900 MW to 650 MW and also poor yield from hydel reservoirs is creating an expensive predicament, thermal power too is not beyond agenda etc leads KSEB in to a situation of Negative Surplus Power in 2009-10 though there was significant increase in hydel generation, negative situation occurred mainly due to the drastic reduction in the purchase of power from IPPS and decline in thermal power generation and at the same time the total requirement increased to 17335.57 MU in 2009-10 from 16069.42 MU in the previous year. The details are shown in Table 7.8

**Table 7.8**  
**Details of Power Availability as on 31.03.2010**

Sl. No.	Internal Generation	Million Units
1	Hydel Generation	6646.27
2	KSEB -Thermal Generation	592.27
3	Wind	1.84
4	Total Internal Generation	7240.38
5	Less Auxiliary Consumption	50.87
6	Power Purchase from CGS	8440.39
7	Power Purchase from IPPs	772.13

8	Total Energy Availability	16402.00
9	Energy requirement	17335.57
10	Surplus	-933.54

Source: KSEB

### Power Consumption

7.24 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 last year (12877.65 MU). The details of consumption and revenue collected during 2009-10 can be seen in the Appendix 7.6

7.25 As per the 17th Power Survey, it is estimated that by the end of 11th plan period (2012), the annual consumption and maximum demand will be 19230 MU and 3528 MW respectively.

### Power Purchase Agreement (PPA)

7.26 KSEB has entered into PPA with various Central Power Generating Stations of NTPC, NLC, NPCIL etc. envisaged for Southern Region. In addition to this, power was purchased from Rajiv Gandhi combined cycle power plant of NTPC at Kayamkulam, BSES Kerala Power Ltd, Kochi and Kasaragod Power Corporation Ltd., Mylatti. Recently, KSEB has also executed PPAs with Mega Power Projects such as SIMHADRI Stage II, NLC, Tutucorin-a joint venture project of NLC and TNEB, NLC Stage II expansion etc. As a measure to encourage non-conventional sources of energy, KSEB has executed 38 PPAs for purchase of power from wind energy projects and from two Small Hydro Projects, namely, Meenvallom and Iruttikkanam. The capacity allocated from various stations for which the PPAs have been executed is given in the table 7.9

**Table 7.9**  
**Power Purchase Agreement with Various Stations**

Sl. No.	Name of the Stations	Allocation MW
<b>I</b>	<b>CGS</b>	
<b>A</b>	<b>Nuclear Power Stations</b>	
1	Kaiga I & II	38.00
2	Madras Atomic Power Station (MAPS)	18.00
<b>B</b>	<b>Thermal Power Stations</b>	
1	NLC Stage II -ITPS II – Stage I	63.00
2	NLC Stage II – II	90.00
3	NLC Stage I –Expansion	58.80
4	NLC Stage II Expansion	70.00
5	Ramagundam I & II	245.00
6	Ramagundam III	61.00
7	Talcher II	280.00
8	RGCCP	180.00
9	Simhadri Stage II	80.90
10	Vallur Thermal Power Plant (VTTP)	75.00
11	Tutucorin	122.00
<b>II</b>	<b>IPPs</b>	
<b>A</b>	<b>Thermal</b>	
1	BSES Kerala Power Ltd	157.00
2	KPCL	20.436
3	MP Steel	
<b>B</b>	<b>Hydro</b>	
1	Meenvallam	3.00
2	Iruttikkanam	3.00

C	Wind	
1	Agali	13.8
2	Ramakalmedu	14.25

Source: KSEB

7.27 Kerala is planning a capacity addition of 610.50 MW (1653.86 MU) through hydel and non- conventional sources during the Eleventh plan. Allocation of 733 MW power from the projects viz. Koodankulam Atomic Power Station (266 MW), Neyveli Lignite Corporation Expansion (70 MW), Simhadri Thermal Power Station (200 MW), Vallur (75 MW) and Tuticorin (122 MW) are expected. To fulfill the demand in 12<sup>th</sup> plan period, KSEB has planned for 1000 MW coal based project. Allocation of coal (200.66 MT) for generating 1000 MW power for the next 25-30 years from Baitarni West Coal Company Ltd (BWCCL) in Orissa has already been obtained from Ministry of Coal, Government of India.

### Cheemeni Power Plant back in favour

7.28 The Kerala State Electricity Board is seriously contemplating the setting up of a 2400 MW thermal power project at Cheemeni in Kasaragod district. The coal for this project will come from the coal field. The Union Government has allotted coal for Kerala from Orissa. A Company for undertaking the mining operations has already been set up there by the KSEB in association with outside public sector power utilities. The Centre would provide all assistance for the project. The centre was attaching top priority to power capacity addition all over the country.

7.29 Earlier, Kerala has been wavering between the options of setting up a pit head power project in Orissa in association with outside public sector power utilities and having a new power projects in the State itself to utilize the coal from the field allotted to it in Orissa. Land is already available for the project at Cheemeni. KSEB was taking concrete steps to ensure long term power security in the State. With the commissioning of the LNG Terminal in Kochi, expected by 2012, natural gas would be available as fuel for power generation here. The plant now upgraded the KSEB's Brahmapuram Power Project to 1000 MW capacity, in addition to setting up one more project with a capacity to generate 1000 MW of electricity with LNG as fuel. KSIDC has been appointed as the nodal agency for setting up the project. A special purpose vehicle will be formed between KSIDC and KSEB with 50:50 participation for implementing the project. Board has decided to transfer its share of 5 MT per annum of coal produced from Baitarni West Coal Block to the Cheemeni project.

### Growth of Power System in Kerala

7.30 Growth is necessary in every sector in the power system particularly, generation, and transmission. As on 30.09.2010, installed capacity has been hiked by 2746.19 MW as against the 2685 MW in the same period of previous year. Likewise, per-capita consumption has also been increased by 544 KWh. The details of growth of power system in Kerala is seen in Table 7.10

**Table 7.10**  
**Growth of Power System in Kerala**

Particulars/Year	2008-09	2009-10	2010 upto 30.09.2010
Installed Capacity (MW)	2685.00	2746.19	2850
Annual Sales (MU)	12414.32	13971.09	
Per-capita Consumption (KWh)	490	544	
EHT lines (circuit KM)	10139	10406	10501
Sub stations (Nos)	305	330	335
H.T. lines (circuit KM)	41791	45540	46537
L.T lines (circuit KM)	252458	260670	263211
Distribution Transformers (Nos)	46955	52724	54437
Revenue from sale of power (Rs.crores)	4893.02	4747.17***	

Source: KSEB



\* Population based on 2001 Census

\*\* includes 1 No. 400 KV Pallippuram S/s of PGCIL

\*\*\* Provisional

## Hydro - Thermal Energy

7.31 Taking into account the present hydro storage status in the reservoirs, expected, an inflow equivalent to the average of past 10 years during the remaining period of the current water year (2009-10), the present allocation from the CGS and CERC norms for target availability and auxiliary consumption, the average quantum of energy expected to KSEB from CGS is 18.48 MU per day. Expecting the nominal pattern of increase in peak demand during summer months, KSEB proposed to schedule about 40 MW from BDPP and 60 MW from KDPP during peak hours to meet the evening peak demand. Hydro-thermal mix in Kerala is shown in Table 7.11.

**Table 7.11**  
**Hydro-Thermal Mix in Kerala from 2003-04 to 2009-10**

Year	Hydel (MU)	Thermal + Import (Mix) (MU)	Total (MU)	Hydel (%)	Thermal (%)
2003-04	3910	8545	12455	31	69
2004-05	6134	6314	12448	49	51
2005-06	7539	5866	13405	56	44
2006-07	7497	7029	14526	52	48
2007-08	8327	6884	15211	55	45
2008-09	5839	10283	16122	36	64
2009-10	6612	10777	17389	38	62

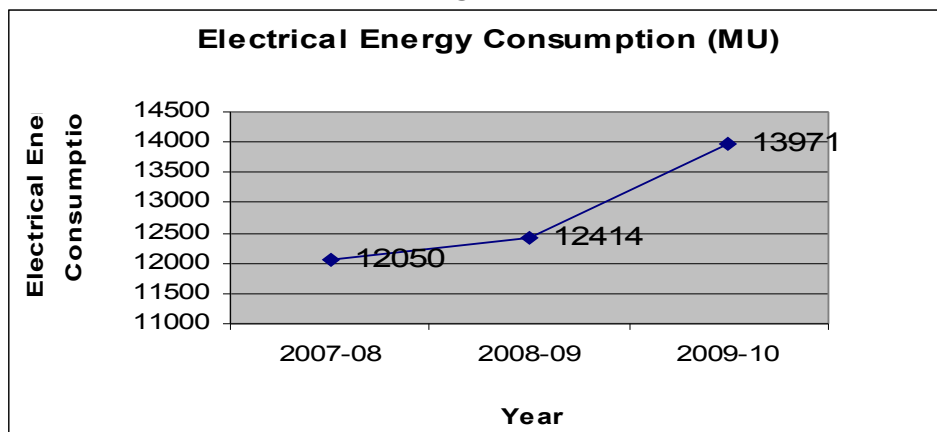
Source: KSEB

7.32 The ratio of hydro-thermal mix indicates that from 2005-06 to 2007-08 availability of hydel power has comparatively outnumbered the thermal power and subsequent years thermal power increased till 2009-10. It reveals that KSEB has purchased high cost thermal power than generating hydel power.

## Electrical Energy Consumption

7.33 In Kerala, electrical energy consumption has increased to 13971 MU during 2009-10 from 12414 MU during 2008-09. The percentage of consumption increased to 12.5 %. Electrical Energy consumption in Kerala during 2007-08, 2008-09, and 2009-10 depicted in Fig 7.2

**Fig: 7.2**



## Transmission

7.34 Transmission of Electricity is defined as bulk transfer of power over a long distance at high voltage, generally of 132 KV and above. 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 Nos of substations and construction of 587.19 kms of transmission lines has been targeted during the period under review. Out of which 29 substations were completed and 10490 ct kms of lines were commissioned as on 31.09.2010. Now there are two 400 KV substations. One at Madakkathara (Thrissur) and the other at Pallippuram (Thiruvananthapuram). Also another 400 KV substation at Arecode (Malappuram District) is being constructed by 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.

7.35 As per the scheme approved by Southern Regional Electricity Board (SREB), 400 KV Multi – Circuit line is proposed from Thirunelveli – Edamon and 400 KV Double Circuit line from Edamon-Kochi (East) Madakkathara. One 400 KV sub station at Kochi (East) is also sanctioned as part of this evacuation scheme.

7.36 Kerala's Transmission system consisting of substations and its connected lines are given with Tables 7.12 and 7.13

**Table 7.12**  
**Transmission Infrastructure**

Sl. No	Item	Target	Unit	Achievement	Unit	Percentage of Achievement
1	400 KV Substation	Nil	Nos	Nil	Nos	
2	220 KV Substations	3	Nos	2	Nos	66.67
3	110 KV Substations	20	Nos	9	Nos	45.00
4	66 KV Substations	4	Nos	-	Nos	0
5	33 KV Substations	39	Nos	18	Nos	46.15

Source: KSEB

7.37 It can be observed that, performance of the construction of substation with various capacities has not achieved the intended target. The table 7.12 reveals that one 220 KV and none of 66 KV substations was not completed against its targets of 3 & 4 respectively. The construction of 110 KV and 33 KV sub stations are still at a snail's pace: Out of the target of 20 numbers 110 KV substations, only 9 substations are completed and in the case of 33 KV substations, 18 substations are completed against the target of 39 numbers. It will have an adverse impact on power evacuation facility.

**Table 7.13**  
**Transmission facilities in Kerala (As on 30.9.2010)**

Capacity	Substation (Nos)	Lines (Ct km)
400 KV	2*	260**
220 KV	17	2701
110 KV	123	4002
66 KV	82	2387
33 KV	111	1400
<b>Total</b>	<b>338</b>	<b>10490</b>

Source: KSEB

\* One number owned by PGCIL

*\*\* owned by PGCIL*

### **Kayamkulam Expansion remains non-operational**

7.38 There are apprehensions that the NTPC might not go ahead with the expansion of the Kayamkulam plant by 1950 MW in the next plan by shifting to Liquefied Natural Gas (LNG) as fuel. KSEB is also exploring the feasibility of converting the Brahmapuram Diesel Power Plant into a 1000 MW gas based project by utilizing the gas from proposed Petronet LNG / GAIN Gas Projects.

### **Voltage Improvement Works**

7.39 KSEB is committed to provide 230 volts between phases and neutral consumers premises in the L.T services and corresponding higher voltages in the case of higher voltage service within allowable limits. KSEB cannot always fulfill this commitment due to rapid load growth and corresponding changes in system parameters. When conditions prevailing low voltage in any locality come to the notice of KSEB, work to improve voltage is taken up as voltage improvement work. This is usually carried out at the expense of the Board. Converting existing single phase lines to 3 phase, strengthening distribution system by providing higher capacity conductors, providing additional transformers on the existing 11 KV line or by extending 11 KV line by providing adequate size of capacitors are the works usually carried out for providing higher voltage in distribution network.

### **Renovation, Modernisation and Uprating (RMU) of old Generating Stations**

7.40 The normal life span of a hydro generating station is 30-40 years, depending on service conditions in many of our existing generating stations are old and in service for 30 years and beyond. When the machines become old, their operational efficiency decreases. Major breakdowns occur and shutdowns of long duration will be necessary for maintenance work.

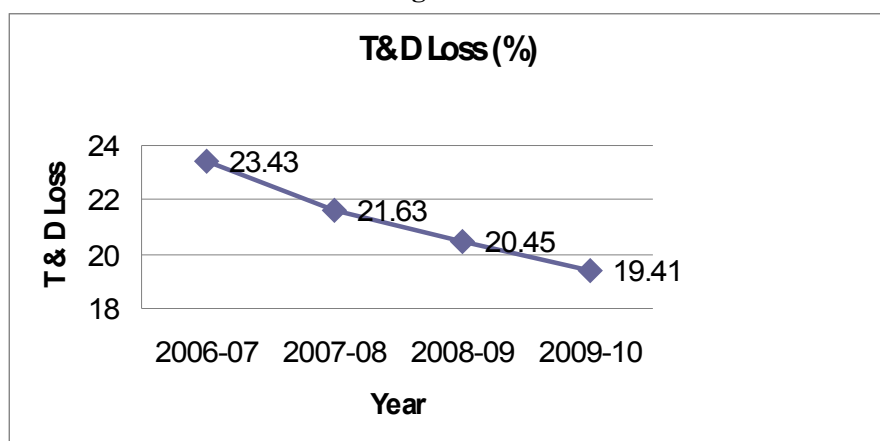
7.41 The renovation and modernization of Pallivasal, Panniar, Shengulam and Neriamangalam Projects have been completed. In the case of R&MU of rehabilitation of Panniyar Power House, rebuilding of (unit 3 & 4) of Sabarigiri powerhouse, Idamalayar protection works are being undertaken.

### **Transmission and Distribution Loss (T&D loss)**

7.42 KSEB have to bear proportionate losses in PGCIL line through which allocation to KSEB from Ex bus of Central Generating Stations (CGS) is transmitted to KSEB Periphery and this loss component is treated as external losses to KSEB system. The energy loss in the KSEB System is accounted as internal loss.

7.43 During 2009-10 T&D loss has come down to 19.41 percent from 20.45 percent in 2008-09. 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% every year. It can be seen in the fig 7.3

Figure 7.3



## Distribution

7.44 Distribution Sector is a profound area, which provides electricity to all consumers in Kerala. In the distribution segment, 3398.27 kms of 11 KV lines, 7838 kms of LT lines and 5790 nos of distribution transformers were added during the period under review. Kerala has achieved full electrification in all villages, which is above average of national level. KSEB has given great attention to strengthen the distribution backbone by new ventures of Restructured- Accelerated Power Development and Reforms Programme (R- APDRP) and Rajiv Gandhi Grameen Vidhythikaran Yojana (RGGVY). The power consumption comes to all time high. As on 31.3.2010, total number of consumers has increased to 9743476 nos against the 9363461 nos as on 31.3.2009. The details of pattern of power consumption and revenue collected are shown in the Appendix 7.6. The distribution infrastructure is essential part of electrifying all domestic and non-domestic purpose. The target and achievement of the distribution infrastructure during 2009-10 is given in the Table 7.14

**Table 7. 14**  
**Targets and Achievements of distribution Infrastructure during 2009-10**

Sl. No.	Item	Target	Unit	Achievement	Unit	Percentage of Achievement
1	11 KV Lines	4880	Kms	3398.27	Kms	69.64
2	Distribution Transformer	5400	Nos	5790	Nos	107.22
3	L.T. Lines	6666	Kms	7838.00	Kms	117.58
4	Service Connections	512920	Lakhs	447817.0	lakhs	87.31

Source: KSEB

7.45 The above table reveals that lying of LT lines and 11 KV lines the expected target could not achieved whereas effecting new service connections and distribution transformers that achievements exceeded the targets.

7.46 During the financial year 2009-10, 447817 service connections were given till 30.09.2010 against the target of 512920 and 3398.27 kms of 11KV lines, 5790 nos of transformers and 7838 kms of LT lines were commissioned during the year.

## **Schemes for the Poor**

7.47 As part of providing electricity to households as social obligation belonging to consumers Below Poverty Line (BPL) at the cost of the KSEB. The criteria for selection to be considered in this group based on the proof connection and connected load should not exceed 500 MW. Houses wired up at the cost of the agencies such as local bodies, NES Blocks, Residents Association, Co-operative societies etc are eligible to be considered in this scheme.

## **Tariff**

7.48 During the period 2009-10, there was no thermal surcharge imposed to all categories of consumers including licensees.

7.49 Overall average realisation rate from tariff has been decreased to 338.03 paise Per Unit in 2009-10 as against the 380 Paise per Unit in 2008-09; the major contribution for raising realisation rate from tariff was sold to NVVN/PTC. During 2009-10, Board sold energy to NVVN/PTC @ 1259.31 paise per unit. The details can be seen in the Appendix 7.4 and 7.5

## **The Electricity (Amendment) Act, 2007**

7.50 The Electricity (Amendment) Act, 2007, enacted on May 29, 2007, and brought into force from June 15, 2007, amends certain provisions of the Electricity Act, 2003. Its main features are:

- The Central Government, jointly with the State Governments will endeavour to provide access to electricity to all areas including villages and hamlets through rural electricity infrastructure and electrification of households;
- No licence is required for sale from captive units.
- Deletion of the provision for elimination of cross subsidies. The provision for reduction of cross subsidies would continue.
- Definition of theft expanded to cover the use of tampered meters and use for unauthorised purpose. Theft is made explicitly cognizable and non-bailable.

## **Corporatisation of KSEB**

7.51 In order to comply with the provisions of Electricity Act and the Government of India directives, the Kerala Government notified a transfer scheme vide GO (M.S) No.37/2008/PD dated, 25.9.2008 through which all assets and liabilities of KSEB are vested with the State Government. These Assets and Liabilities now vested with the Government will be re-vested in a fully owned government company to be incorporated under the Companies Act

7.52 Activities for registration of a company to re-vest the assets and liabilities of the Board are in progress. The Memorandum of Association (MoA) and Articles of Association (AoA) of the proposed company were prepared by the M/s Mohan and Mohan Associate, Chartered Accountants, engaged as consultants for the work. The Government has approved the Memorandum and articles of association and decided the name of the proposed Company as 'Kerala State Electricity Board Limited'. The Government has also appointed the existing members of the Board as First Directors of the proposed Company. Application has been filed with the Registrar of Companies for registration of the Company and is being processed

7.53 To assist the Board in restructuring process, M/s PFC Consultancy Ltd, New Delhi (a subsidiary of Power Finance Corporation) is engaged as consultant. The major works in restructuring include preparation of Transfer Scheme for re-vesting, preparation of Financial

Restructuring Plan, creation of Pension Fund etc. The draft transfer scheme prepared by the consultant is under consideration of the Government. The re-vesting assets and liabilities to the New Company by December 2009.

### **R-APDRP (Restructured APDRP) Scheme**

7.54 Sanction for implementation of R-APDRP scheme during 11<sup>th</sup> Five 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.

7.55 The project has 2 parts – PART – A & PART – B. Part-A covers establishment of base line data and IT applications and Part-B includes regular distribution strengthening projects. Apart from this, the programme will require enabling activities, which will be covered under Part-C.

7.56 The quadripartite agreement (MoA) for the scheme duly signed by the Principal Secretary (Power), Govt. of Kerala and the Chief Engineer, Corporate Planning, KSEB, Power Finance Corporation Ltd and the Govt of India is executed on 17.8.2009.

7.57 The revised DPRs of the districts of Kottayam, Shornur, Ottappalam, Palakkad, Taliparamba, Vadamara, Thrissur and Kodungalloor submitted to the PFC during the month of July – August 2010. DPRs of Thiruvananthapuram, Kozhikode and Kochi transmitted to the PFC for appraisal.

### **Rajiv Gandhi Grameen Vidyuthikaran Yojana (RGGVY)**

7.58 Under the Rajiv Gandhi Grammeen Vidyuthikaran Yojana (RGGVY), sanction has been obtained to implement the scheme in 7 districts of Kerala, namely, Kasargod, Kannur, Kozhikode, Wayanad, Malappuram, Palakkad and Idukki with an amount of ` 221.75 crore as a first package on 5.8.2005. A tripartite agreement has been executed among Government of Kerala, REC and KSEB on 21.07.2005 and turnkey tender invited for 7 districts. For Idukki district, work order issued and agreement has been executed. The revised rate sanctioned by REC for implementation of the scheme in Idukki District is ` 1995.22 lakh. The scheme ended on 30.06.2010.

7.59 REC issued sanction on revised DPR for Kasargod, Kannur, Kozhikode, Wayanad, Malappuram and Palakkad for a total amount of ` 114.57 crore.

7.60 The revised DPR for implementation of the scheme in Thiruvananthapuram, Kollam, Pathanamthitta, Kottayam, Alappuzha, Ernakulam and Thrissur districts for an amount of ` 8348.35 lakh are submitted to REC for approval.

7.61 The details of the financial and physical progress of implementation of RGGVY as on 30-09-2010 is shown in the Table 7.15.

**Table 7.15**  
**Financial & Physical Progress of implementation of RGGVY as on 30.09.2010**  
 ( ` lakh)

Sl. No.	Name of Item	Unit	Amount released	Target for 2006-07 to 30.09.2010	Achievement as on 31.09.2010	Expenditure As on 30.09.2010
1	Installation of 25 KVA transformer	No.	1654.90	275	275	1755.022
2	Construction of 11KV Line	KM		272.5	249.944	
3	Construction of LT single phase line	KM		320.53	368.688	
4	Construction of LT three phase line	KM		76.18	63.511	
5	Effecting BPL/SC service connection	No.		160.97	17238	

Source: KSEB

### Power Sector Reforms

7.62 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% every year. T&D loss brought down to 19.41 percent as on 31-3-2010.
- 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

### Non – Conventional Energy

7.63 The major programmes targeted by ANERT during 2010 comprises of Baseline studies on energy demand, renewable energy potential and energy conservation potential, implementation of renewable energy and energy conservation programmes and infrastructure development for sustaining interactive energy planning and development programmes with local governments.

### Baseline Energy Studies

7.64 As part of the baseline energy demand studies ANERT had carried out a detailed study of the households that are yet to be electrified. The total houses registered as Un-electrified counts to 2,03,694 from the 454 local bodies. The direct survey conducted in these households covers the reason for non-electrification as well as the distance of existing grid from the surveyed houses as well, along with an estimation of power requirement. The data being consolidated forms a firm basis for charting out programmes for the coming years with a focus to achieve the long cherished dream of the State to achieve 100% household electrification, through collaborative functioning with Local Self Governments and KSEB.

7.65 Under the renewable energy potential assessment studies ANERT had compiled the Database on Probable SHP sites in the state covering 867 locations spread over 163 local bodies in 13 districts of the State, having a total estimated potential of 331 MW at 30 % dependability. In continuation to this, detailed study of a cluster of sites with 14 locations in Peravoor of Kannur district has also been completed and the implementation of these projects with RIDF support as a model for cluster based development of mini hydel projects. Steps for taking forward Wind Energy potential assessment studies in collaboration with Centre for Wind Energy Technology (C-WET) are also being planned.

7.66 Energy conservation potential assessment studies planned for the year comprised of energy audit in 10 selected institutions transferred to local governments and installation of renewable energy and energy conservation devices based on the recommendations of the study. Presently energy Audit Study of 5 institutions are completed with the help of the Energy and Resources Institute ( TERI).

### Implementation of Renewable Energy and Energy Conservation projects

7.67 The implementation of centrally sponsored Remote Village Electrification Programme has marked 100 % achievement during 2009 by providing the electric light in 4204 remotely located backward class households. The districtwise distribution of remote households electrified under this programme with Solar Home Lighting Systems includes 645 houses in Thiruvananthapuram, 146 houses in Patanamthitta, 2863 houses in Idukki, 349 houses in Palakkad and 201 houses in Kasargod. The details of remote village electrification during 2009 are shown in the table 7.16.

**Table 7.16**  
**Details of Remote Village Electrification 2009**

Sl. No.	District	Name of Grama Panchayath	Total no. of beneficiaries
1	Thiruvananthapuram	Kuttichal	252
2	Thiruvananthapuram	Vithura	393
3	Pathanamthitta	Kalanjoor	146
4	Idukki	Mankulam	1824
5	Idukki	Velliamattom	64
6	Idukki	Udumpanoor	128
7	Idukki	Kanjikuzhy	190
8	Idukki	Vattavada	422
9	Idukki	Kanthalloor	99
10	Idukki	Santhanpara	17
11	Idukki	Vazhathope	8
12	Idukki	Arakkulam	100
13	Idukki	Upputhara	11
14	Palakkad	Agali	349
15	Kasargod	Panathadi	197
16	Kasargod	Delampady	4
	<b>Total</b>		<b>4204</b>

Source: ANERT

7.68 Distribution of Renewable Energy and Energy Conservation Devices was another major programme taken up by ANERT under Total Energy Security Mission project jointly with the various Local Self Government Institutions. The achievement of this programme includes supply of 107 Solar Water Heaters of varying capacities, 387 Solar Cookers, 266 Solar Home Lighting systems, 9000 Retained Heat Cookers and 6114 improved domestic Biomass Cook Stoves.



7.69 ANERT had also taken up programme in collaboration with the District Panchayats for decentralized energy generation through community scale projects. This includes projects for installation of Institutional Biogas Plants (10 numbers), Biogas Plants for High Water Table area (2 nos), Biomass Gasifiers (14 nos), Gasifier based Crematorium (2 nos), Scheffler Cookers (2 nos) and Solar Steam Cooking units (4 nos).

### **Infrastructure Development for Sustaining Initiatives with LSGIs**

7.70 Establishing the Centre for Excellence on Renewable Energy (the Centre for Capacity building in Renewable Energy and Conservation (C-CNREC) has progressed substantially with the commencement of the pioneering project, the Model Residential Polytechnic (MRP), which had started functioning at Kuzhalmannam, Palakkad. The Polytechnic is providing courses in Green technology related sectors with 60 % of the total seats reserved for students from SC – ST families. The work of construction of the green campus and other infrastructure for the Centre of Excellence is progressing.

7.71 Establishment of the network of entrepreneurs (Energy Marts), construction work of ANERT Headquarters building incorporating SMART building components, consultancy supports with the expert consultancy agencies etc are also progressing.

### **Conservation of Energy**

7.72 The following are major activities and notable achievements conducted by EMC during 2009-10

- ◆ Bachat Lamp Yojana (BLY) was implemented with the support of KSEB in the State of Kerala by replacing two incandescent lights by two CFLs in Domestic Sector. Nearly 1.3 crores of CFLs were distributed to the domestic sector. This project resulted in a saving of 250 MW. Also load shedding was averted during the month of March to June 2010.
- ◆ EMC is the State Designated Agency to implement Energy Conservation Act 2001.
- ◆ During the year 2009, the participated industries in the Energy Conservation Award saved 77.76 MU which avoided Equivalent Capacity 14 MW.
- ◆ EMC developed an Almanac fed electronically controlled Automatic Street Light Switching device for switching on and off streetlights.
- ◆ EMC developed an Energy Conservation Web Portal for activities with Bureau of energy Efficiency, ministry of Power, Government of India and other stakeholders.
- ◆ Trained Designated Consumers on e-filing/analysis of energy data as part of the Energy Conservation Act.
- ◆ As part of the State Designated Agency Activity, refresher training programme was conducted to Certified Energy Auditors and Energy managers.
- ◆ Completed the Investment Grade Energy Audit in 22 Government Buildings.
- ◆ A demonstration project on the LED based Streetlight project was taken up and Vellayambalam – Vazhuthacaud road was selected for the implementation.
- ◆ 15 Touch Screen energy efficient information kiosks were developed.
- ◆ Peringottukurissi in Palakkad district was selected for the implementation of LED Village Programme by replacing the incandescent lamps with energy efficient LED lamps as part of the Bureau of Energy Efficiency project.

## **Enforcement of Standards and Statutes**

7.73 The Electrical Inspectorate is a department of the Government of Kerala. Safety inspections are carried out and sanction for energisation for all HT / EHT and other medium voltage installation in the State are issued by this department. Enquiry of all electrical accidents occurred in the State and forwarding the enquiry report to the Government and take actions against responsible person / authority are also done by this department.

## **Activities and Achievements for the year 2009-10**

- ◆ By the implementation of the office automation, the department would achieve the prestigious 'SEVOTHAM CERTIFICATION' (SQMS Certification) as per IS 15700: 2005 from the Bureau of Indian Standards. This certificate is issued for the implementation of the Service Quality Management System in Public Service Organisation. It is the first department in the country, which bags this certification.
- ◆ The department has received the first E- Governance Award from the Honorable Chief Minister of Kerala for being the first department in the State implementing SPARK solutions efficiently.
- ◆ During 2009-10 the department has executed the programmes like purchase of equipments, calibration of instruments / equipments / NABL accreditation repair of equipments etc.
- ◆ By the partial implementation of the plan proposals, the department could procure certain equipments / instruments for the scope of enhancement of NABL accreditation incorporating ENERGY parameter. The NABL assessment team will be visiting the Laboratory soon for the same.
- ◆ The functioning of the Information Kiosk at the CEI office and enquiry points at the district offices was also highlighted.