CHAPTER- 2

REVIEW OF LITERATURE

Electric power is the most widely used source of energy both as a motive force as well as input in economic activities. Pricing policy of electricity has significant influence not only on the growth of electricity supply industry but also on overall economic efficiency, investment, growth, and equity in the economy. An efficient pricing policy of electricity is expected to give appropriate signals for investment, production and consumption\(^1\).

Pricing is considered as a powerful and versatile tool for affecting demand in the long run. But in the short run, sharp changes in prices may have only limited effects on demand but major effects on revenue flow. Pricing mechanism may be applied directly to given energy sources by charging the final prices to end-users. It can also be applied indirectly by affecting the prices, costs or availability of energy using appliances\(^2\).

Pricing system for public utilities are analysed from the points of view of producers as well as consumers pricing. Producer pricing should

\(^{1}\) GOI, India Infrastructure Report, 2000, Vol.III, pp. 53-96

\(^{2}\) Dholakia Ravindra H and Oza Ajay N (1999), *Microeconomics for management studies*, OUP, Mumbai
be set in such a manner that the goal of optimal use of existing resources, which would enable efficient expansion of output at minimum possible cost, is brought about. The objective of consumer pricing is to provide appropriate signals to consumers regarding their consumption behaviour.

Basically, the pricing policy for public sector enterprises/utilities depends on nature and characteristics of public utilities. Moreover, in such utilities central/state governments play a significant role in formulating pricing and distribution polices to achieve socio-economic objectives. The socio-economic objectives of public utilities have implication for electricity pricing. Economic objectives are related with the optimal utilisation of resources and to fair rate of return on the capital invested, while social goals are concerned with the maximisation of social welfare. Both the objectives may conflicting.

In a freely competitive market, price of a commodity represents its utility to the buyers and average cost of production to the producers. As far as the buyer is concerned, this principle holds true even in case of goods/service produced by public utilities, particularly in a country

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where democratic freedom governs socio-economic goals. It is also true that the consumers do not have much choice if any body else does not produce the goods/services produced by public enterprises/ utilities. While the position is significantly different in public utilities in case of supply side. It may also be noted that in the long run private producers must get a price, which covers total cost and provides an adequate return necessary to attract venture capital. In contrast, non-commercial considerations may influence the determination of prices in public enterprises. It is remarkable to note that there is a difference between the goals pertaining to government departments and public enterprises. Government departments are operated more with non-commercial considerations i.e. social, political & administrative and less with commercial. Public enterprises are established mainly with commercial obligations alongwith welfare considerations for the society as a whole. Therefore, it is necessary to specify the goals of various organisations clearly prior to implementing any pricing policy. Having commercial attitude along with welfare commitments of a public enterprise it is argued that public enterprises should be considered as a public sector firms with the main objective as minimisation of long run average cost. In the prevailing scenario non-commercial considerations appear to
influence the day to day functioning and the process of formulating pricing policy in public utilities⁵.

A public utility may generate a surplus through an appropriate pricing policy to enable their own expansion, technological upgradation and research & development. Sometimes a utility may charge less than full equilibrium price for the service it rendered to consumers because of its forward & backward linkages with the economy. However, the government should compensate the utility on this account⁶.

Pricing mechanism performs a number of critical functions. Basically the role of prices is to balance/equate the consumer demand with producer supply. Prices also provide the revenue basis for the producers. Government uses pricing as a tool to achieve policy objectives⁷.

In India, Section 59 of the Electricity (Supply) Act, 1948 envisaged that a State Electricity Board (SEB) should earn a minimum return of not less than 3 per cent on its average capital base after fully meeting fixed and operating cost, interest and tax liabilities⁸.

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⁵ Gupta & Gupta (1996), Electricity Pricing in India, Printwell, Jaipur.
⁶ GOI (1981), Electric Utility Rate Design, No. VII, Central Electricity Authority, New Delhi
⁸ The Electricity (Supply) Act, 1948, pp. 47-48
The Electricity (Supply) amendment Act 1978 also emphasised that the power utilities should not carry on their functions/operations at a loss and should adjust their tariffs accordingly from time to time\(^9\). This provision was made statutory in 1985, which must be enforced by the SEBs. The financial performance of any utility depends upon its pricing policy and management efficiency. Upto now, the government owns power sector and the prices & investment decisions regarding this sector are to be made by government administration which appear to be arbitrary leading to financial crisis. This vary fact has also been observed by the various committees constituted by the governments from time to time to examine and make recommendations\(^10\).

It has been observed from the expert committee (Rajadhayaksha Committee) report that there are today no principles guiding the power tariff structure and the decisions are made largely on grounds of political expediency. There is considerable evidence to suggest that in rural areas the large and more affluent farmers who could well afford to pay the real cost of their power supply, are enjoying the benefits of the power subsidies. Irrational tariff structure promotes inefficiency in the use of electricity and deteriorates the financial performance of the power sector.

\(^9\) The Electricity (Supply) Act, 1948, amended, pp.28-29
The poor financial positions of the power sector slow down the progress of the other sectors of the economy because the financial resources have been allocated to this sector at the cost of others for increasing installed capacity to meet excess demand. If the transfer of resources from other sectors to power sector is nominal then the lack of investment in the power sector for generation, transmission and distribution of electricity leads to power shortage which in turn, would slow down the economic development of the country, especially in the agriculture and industrial sectors.

Rajadhyaksha Committee also realised that 11% rate of return on average capital base as suggested by earlier committee (Venkataraman Committee) is not sufficient to generate adequate resources to meet the requirements of the power industry in India. That’s why this committee had recommended that the State Electricity Boards should earn a rate of return of 15 percent on the average capital base after providing for operating expenses and depreciation.

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12. Rajadhyakasha Committee (1980), pp. 79
World Bank Report (1980) argued that due to excess interference of political system in the decision making process, SEBs are progressively transformed into an extension of the state governments\(^{13}\).

The conference of Power Ministers of States in 1991 realised that a situation is fast developing that if urgent corrective steps are not taken immediately to rationalise the tariffs and adopt other measures to improve the financial performance of the SEBs, the functioning of the entire power sector would be jeopardised with serious repercussions on the overall socio-economic development of the country. A stage is now reached where this situation is already affecting the entire power sector and in absence of corrective measures the industrial and agricultural sectors will be hit in the long run\(^{14}\).

Further, Ninth Five Year Plan (1997-2002) envisaged “the most important cause of the problems being faced in the power sector is the arbitrary and unremunerative tariff structure. Although the tariff is fixed and realised by SEBs, the State governments have constantly interfered in tariff setting without subsidising SEBs for the losses arising out of state governments desire to provide power at concessional rates to certain


\(^{14}\) Conference of Power Ministers of states held on 6\(^{th}\) September 1991.

sectors especially agriculture. Therefore, power supply to agriculture and domestic consumers is heavily subsidised. Only SEBs through cross subsidisation of tariff from commercial & industrial consumers cover only a part of this subsidy. The SEBs, in the process, have been incurring heavy losses. If the SEBs were to continue to operate on the same lines, their internal resource generation during the next ten years will be negative, being of the order of Rs. (-) 77000 crores. This raises serious doubts about the ability of the states to contribute their share to capacity addition during the Ninth Plan and there after. This highlights the importance of initiating power sector reforms at the earliest and the need for tariff rationalisation.\textsuperscript{15}

India Infrastructure Report (2000) makes it clear that at the root of chronic inability of SEBs to raise required investment is the uneconomic pricing of electricity. Absence of cost based economic principles in consumer category-wise tariff design, uneconomic level of cross subsidies, reliance on historical rather than marginal costs and inability to cover the costs incurred are the main weaknesses in the tariff policy.\textsuperscript{16}

\textsuperscript{16} GOI, India Infrastructure Report, 2000, Vol.III, pp. 59
Tenth Five Year Plan (2002-07) highlighted that the power sector has been suffering from serious problems which were identified as early as ten years ago. However, no corrective action was taken and the result is that the power sector faces an imminent crisis in almost all States. No State Electricity Board (SEB) was recovering the full cost of power supplied, with the result that they made continuous losses on their total operations\(^{17}\).

Besides expert committees and government reports/documents independent researchers also highlighted the issue.

Bhalla G.S (1964) pointed that it is impossible to work out purely economic, purely rational and non-political principles of universal validity for setting of prices by means of theoretical economic analysis. Pricing in public enterprises has to be related to the aims and objects an enterprise is enjoined to pursue\(^ {18}\).

A through understanding of the energy particularly electricity pricing mechanism could be considered more critical in energy markets due to high capital intensity and long time associated with investment and return on it. So it is required that electricity prices are set prudently.


and efficiently. If electricity prices are set below the cost of production /supply, it can result negative impacts in terms of over consumption, wasted national scarce resources and environmental degradation. Conversely, if prices are held arbitrarily high industrial competitiveness will suffer and some consumers would be deprived of an essential service.¹⁹

Kumar, Surinder (1984) found that arbitrary and uneconomic pricing policy of the SEBs is the result of excessive interference of state governments in the decision making process of SEBs, particularly in tariff setting. State governments forced SEBs to subsidise some consumers’ categories without any socio-economic justification. There is cross subsidisation that means some consumers categories (domestic and agricultural) are being charged lower than the cost of electricity supplied to them, whereas others (industrial and commercial) are paying more than the cost of supply. The cross subsidisation from industrial and commercial sectors can reduce the losses, incurred by SEBs due to subsidisation of domestic and agricultural sectors, to some extent.²⁰

²⁰ Kumar Surinder (1984), Pricing in Public Utilities: A Case Study of Electricity Undertakings in Punjab and Haryana, unpublished Ph.D thesis submitted to CSRD, JNU
Kumar, Surinder (1985a) has pointed out that the pricing policy should be based on sound socio-economic principles and tariff making should be depoliticised. If agriculture or any other category of consumer is to be subsidized the amount of subsidy should be calculated and state government must pay it to the board from the general public exchequers\textsuperscript{21}.

Rao, Kalirajan and Shand (1998) concluded that prevailing structure of tariffs has provided the wrong signals to consumers of electricity about the current social costs of this intermediate good. This problem has arisen because the costing exercise has been based on historic asset base, on the absence of any incentive structure in the statutory monopoly regime to achieve economic efficiency in electricity supply and on political intervention in the management of SEBs and in the determination of electricity tariffs\textsuperscript{22}.

Singh, Amerjeet (1998) has found that the policy followed for electricity pricing have distorted the demand for electricity and resulted in its irrational use. The electricity charges need to be linked with the


\textsuperscript{22} Rao M Govind, Kalirajan KP and Shand Ric (1998), The Economics of Electricity Supply in India, MacMillan India Ltd, New Delhi.
extent of use to discourage the farmers from uneconomic and wasteful consumption\textsuperscript{23}.

To attain social equity the provision of subsidisation and cross subsidisation may be adopted, but it should be based on economic principles, which directly hit the targeted groups\textsuperscript{24}.

Kumar, Surinder (1999) observed that cross subsidisation is not desirable because on the one hand subsidised sectors consume electricity in inefficient manner, that leads to mis-utilisation of resources, in turn, it rises the problem of scarcity. On the other hand, excess paying sectors have started to invest their funds in captive power generation units to avoid the problems of poor quality and irregular supply of electricity. Most of the captive plants are diesel based. So the cost of power generation through captive plants is high. Excess use of diesel, being diesel an importable commodity has its implications for country's balance of payment. Thus, the policy of cross subsidisation has been the main cause to contribute heavily losses of the SEBs that indicates towards financial crisis. In the situation of financial crisis SEBs are not


only found in a position to generate investable surplus for increasing installed capacity but also start defaulting with central sector power stations (NTPC, NHPC etc.) from where the SEBs purchase power to meet the gap between demand and supply of power. In this way uneconomic and arbitrary pricing policy has not only slowed down the capacity addition of SEBs but it has also slowed down the expansion of central sector power stations. Although cross subsidisation has its implications for SEBs as well as the country as a whole but if the policy of cross subsidisation is to be adopted then it should be based on sound economic principles.

In the prevailing scenario, power sector could be expanded only in a situation to be made it profitable. Profitability can be ensured either by reducing costs or by making suitable adjustments in tariff level & structure. As far as reductions in costs is concerned various measures have to be adopted such as reduction in system losses, better fuel management, better utilisation of the plant, timely recovery of dues, minimising bad debts, controlling theft, reduction in administrative

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overheads etc. While suitable adjustments through tariff increase may not be considered good option from society's welfare point of view.  

The economic logic of the pricing principle implies the inclusion of efficiency criterion by which resources that are allocated to the electric power supply takes into account (1) Opportunity cost of the resources allocated and (2) Consumers willingness & capacity to pay for the service.

It may be pointed out that a reasonable return on investment is necessary if the Board has to provide satisfactory services, meets its financial obligations and attracts new capital needed for future requirements. In tariff setting we must clearly distinct level of tariff from structure of tariff. The level of tariff determines the degree to which total revenue would cover all the reasonable operating cost and provide a fair return on the capital invested, which would be adequate to attract the new capital required. While the structure of tariff is related to the way in which total costs are distributed among the various categories of consumers.

A suitable tariff structure must ensure: simplicity, understandability and public acceptability; feasibility of application for the purpose of measurement, billing and collection of dues, effectiveness in yielding required total return, efficiency in reflecting the true cost of service, thus guiding consumers towards optimum use of electricity. In addition, the tariff structure should be such that: it encourages socially desirable consumption and reduces non-productive consumption; it promotes the widespread use of electricity that would lead to more industrialisation. It becomes instrumental, significant and effective in more desirable allocation of resources.

As a student of economics we should emphasis on the prices, which give signals to consumers to increase or curtail their demand and estimate the incremental costs of meeting that consumption. In other words, prices should reflect the incremental costs of meeting additional consumption and provide the correct signals for the consumption changes.

From efficiency point of view tariffs based on marginal cost principle are appropriate. For efficient allocation of resources prices should be related to the resource costs of changes in consumption. The

rationale for the marginal cost principle lies mainly in welfare economics and the need for optimal allocation of resources. Prices based on the above-mentioned principle perform two kinds of economic functions (1) as it discourages excess consumption of the commodity/service and (2) ensures the desired supply of the concerned commodity/service. The efficient allocation of resources implies no other reallocation can result in an improvement in existing resource allocation.

It may be pointed that there is a basic difference between marginal cost and historical or embedded costs. Marginal cost is a forward-looking concept while historic costs are backward looking concept. Forward-looking concept means when revenue requirements are calculated they are often calculated for a future year. The essence of marginal cost as a forward looking concept is that it relates to the difference in costs between two scales, being difference in costs between producing a little more and little less. The reflection of marginal cost in rate structure leads consumers to make sensible decision regarding electricity consumption. While embedded costs are a matter of sharing out the expenditure/expenses among the consumers, which has already been incurred on their behalf. Marginal cost is forward looking, unverifiable and relevant to

efficient decisions. Historical costs are backward looking verifiable and relevant to equity. Marginal cost pricing provides relevant thought & uncertain information about the future to electricity consumers. Embedded costs pricing, on the other hand, provides irrelevant but certain information\textsuperscript{31}.

For quite some time the economic rationality of marginal cost principle was taken into consideration in the context of price setting of electric utilities. Because of differences in the concept of marginal costs, different methodologies were evolved and differences over major issues persist. Some advocated short run marginal cost (SRMC) be adopted which would mean that costs of providing for additional demand from fixed plant is taken as marginal cost. This is the additional energy cost required to meet additional demand. On the other hand R. Turvey and World Bank suggested long run marginal cost (LRMC) principle for tariff setting\textsuperscript{32}.

It may be argued that marginal cost pricing is the appropriate approach for achieving economic efficiency. Its proper application


require that marginal costs must be estimated on the basis of long run incremental costs which are required to include all current and future running costs plus full replacement costs of all existing plants and equipments. Economic efficiency criterion requires that price charged should be equal to marginal cost. In a world of perfect competition with perfect knowledge and economic rationality shared by both producer and consumers, where there are no economies of scale or lumpiness of investment and no differential in transaction costs both the short run and long run marginal costs will indeed be equal to market price and economic efficiency will be served automatically. But in case of market imperfections the general consensus among economists is that marginal cost pricing principle is the proper principle if economic efficiency goals are to be served. However, the problem arises whether LRMC or SRMC should be used to determine price. Some economists stated that LRMC is consistent with the objective of efficiently allocation of resources because in calculating the LRMC the important consideration is the amount of the future resources used or saved by consumer's decision. In contrast, the propounders of the SRMC stated that the efficient price of electricity is the short run marginal cost of producing electricity. The efficient allocation of resources requires that it may be confronted with
the full costs to society of using them. It implies that users should be confronted with the costs incurred at the margin, the cost at the margin form only a part of the overall costs of supply and of the total opportunity costs to the society of supplying the service. Another part of these costs are the intra – marginal, if these are left or disregarded then the prices that emerge may be either too high or too low and in this situation they will rarely reflect the actual opportunity costs to the society of supplying the service. Ideally speaking, the fundamental objective of marginal cost pricing is that each additional unit of supply should be priced and sold at its own marginal cost. The main problem of this principle is that it may lead to extra ordinary profits if marginal costs are rising and above the average cost of supply or it can result to losses if marginal costs are falling and below the average cost33.

The marginal cost pricing holds that prices should be fixed according to the marginal cost of production, under the competitive conditions, which would lead towards optimum allocation of resources along with optimum level of output. In case of decreasing cost conditions, where average exceeds marginal costs if prices are fixed equal to marginal cost of products the total sale proceeds by charging

marginal cost would be less than total costs. It will have its implications for income distribution and incentive to invest. Moreover, it becomes very difficult to quantify the losses/profits exactly. Next marginal cost cannot be assessed accurately mainly because of existence of indivisibilities. At the point where capacities are being fully exhausted and for meeting additional demand, new capacities have to be created, marginal costs would be extremely high. Thus marginal cost principle cannot be adopted as scale for price fixation. In case where multiple services exist, the determination of marginal costs for each service is very difficult and complicated. The same price cannot be charged for unequal costs. If the prices are equal to marginal cost, fluctuations in demand & supply would create the atmosphere of fluctuations in the price that is undesirable. If the prices are fixed at a level insufficient to cover costs may lead to inefficiency in management. The marginal cost principle will make difficulty in the determination of investment policies of the government, if the scarce resources are used more intensive to expand the output according to the marginal cost principle, it would lead towards mis-utilisation/mal-allocation of resource which have its implications for the economy as a whole.

Through efficient improvement and corrective measures on policy related with appropriate pricing and capital structure a SEB could improve its net surplus. It would make the Board self-sustaining even without government subsidy and enable it to finance capacity expansion programs at least partially from its own resources which would reduce the amount of borrowing. Consequently, the consumers may feel some relief in tariff\[^{35}\].

Kannam and Pillai (2001) concluded that a rational tariff structure should aim to help the SEB to earn a reasonable return over and above the total costs. A rational tariff structure would require charging the consumers for the actual cost of service to them. The price structure must reflect the cost of supply\[^{36}\].

S.L. Rao (2002) pointed out that the state governments have politicised power tariffs within states to such an extent that power is priced well below the costs of service to farmers and domestic consumers in all states. Industry, commercial and railways are overcharged to make up for the losses on these accounts. He, further, argued that various multilateral lending agencies are giving advice in the interest of the


electricity sector in India. But we must not forget these lending agencies are whose mandate is to promote business for their country’s suppliers to protect its lending and make profits. In order to ensure debt servicing such lenders might well promote high end-user tariffs that would enable them to get their money back\textsuperscript{37}.

It has been observed that revenue and expenditure projections and rational tariff determination including subsidies required from the government is the most urgent problem to be dealt with by SEBs. If the consumers could see improvement in quality of service they might be more willing to accept tariff increased compared to the below cost tariff charged at present. Political consensus seems to be that political parties would not stand behind the rationalising of subsidised tariffs and stopping of theft mainly due to the fear of losing vote bank\textsuperscript{38}.

In order to achieve a parettian optimum in imperfect market, prices instead of being made equal to marginal cost in every direction, should be proportional to marginal cost everywhere. The necessary condition for attainment of the optimum situation was that prices should bear the same ratio to marginal costs for each firm and industry in the market. It implies

\textsuperscript{38} Rao M Govind, Kalirajan KP and Shand Ric (1998), The Economics of Electricity Supply in India, MacMillan India Ltd, New Delhi.
that there should be free entry and uniform degree of imperfection in each industry. It was widely believed that, theoretically, the proportionality of marginal costs to price would lead to welfare maximisation. But in actual practice marginal cost pricing fails to provide a correct criterion for optimum allocation of resources, for future investment policy, and for guidance under imperfect competition\textsuperscript{39}.

Actually, there are two different types of view regarding tariff formulation. One stream stresses that prices should be based on efficient performance of the utilities taking into account some important parameters such as the level of generation, plant load factor, plant availability factor, reduction in transmissions and distribution losses, improvement in cost recovery ratio etc. This approach is advocated mainly because the tariffs based on inefficient levels of performance are not desirable. On the other side, another views are that tariffs should be designed taking into account the actual cost of supply because the actual cost concept reflects the possible improvements leading to cost minimisation / reduction\textsuperscript{40}.


Joel, Ruet (2002) argued that due to irrational tariff policy the SEBs are not in a position to invest in cost efficiency measures. In the context of poor financial position, SEBs blame that it is the result of low tariff while governments argue that cost inefficiency is the root cause for their dismal financial performance. Poor financial position of SEBs led their inability to pay the input suppliers and national generation companies. As a result SEBs failed to maintain their assets, postponed investments and has not developed new generation and network capacities to satisfy the demand in both the long-run as well as the short-run. It is also argued that subsidies through under charging to agricultural and domestic consumers have increased mainly due to political decisions. Theoretically, the amount of subsidies has to be paid by state governments through financial transfers to meet the statutory 3% rate of return. But actually, it is not implemented. According to classical theory the main objective of a firm is to maximise profit while in case of public utilities, particularly in natural monopolies, the central goal becomes the minimisation of the long run cost of supply\footnote{Joel Reut (2002b), “Enterprisation of the State Electricity Boards”, The Journal of Institute of Public Enterprise, Vol. 25, No.1, pp. 1-15}.

It may be pointed out that by LRMC actually we mean LRAC because it is a sum of unit capital cost and the unit operating cost.
Computation of the unit capital cost requires information about capacity of the plant, expected life of the plant, time pattern of the output, cost of capital and norms for capacity utilisation. Computation of the unit operating cost requires knowledge of norms regarding usages of labour, material and fuel inputs, prices of such inputs, estimates of maintenance costs and interest on working capital, etc. But the measurement of LRMC poses problems in activities where many technologies coexist\textsuperscript{42}.

Moreover, it may be pointed out that marginal cost approach is not operational in the existing conditions as it is very data intensive and power utilities does not have even basic data with them in the absence of proper metering at various points.

Alternatively, cost plus approach is the best approach for tariff determination. Simultaneously, the utilities must take into account cost of supply for different categories. The main objectives of the cost of supply model are: (1) to identify costs attributable to each category and (2) to identify the extent of subsidy / cross subsidy.

The cost of supply model may become an important tool for tariff fixation and identification of subsidy / cross subsidy. Section 61 (d) of the E Act, 2003 depicts that the consumers should pay for the use of

electricity in a reasonable manner based on average cost of supply". Section 61 (g) of the E Act 2003, shows that the tariff progressively reflects the cost of supply of electricity and also reduces & eliminates cross subsidies within the period to be specified by the appropriate Commissions. Section 62 (3) dictates that the Commission shall not show any undue preference to any consumer of electricity but may differentiate according to the consumer’s load factor, power factor, voltage, total consumption of electricity during any specified period or the time at which the supply is required or geographical position of any area, the nature of supply and the purpose for which the supply is required.

In the regulatory mechanism, it is expected that power utilities will be insulated from unnecessary political interference in the functioning particularly in tariff determination and tariff will be determined on justified grounds in a transparent manner. Moreover, the provision of subsidisation / cross subsidisation will be eliminated in a phased manner to ensure financial viability of the utilities. In this situation, it is desirable to analyse the performance of the power systems in the light of pricing.

43 GOI (2003), The Electricity Act, 2003, p.35
44 GOI (2003), The Electricity Act, 2003, p.35
45 GOI (2003), The Electricity Act, 2003, p.36
policy during pre-reforms and post-reforms periods to see the success of the reforms process in power sector. The analysis of performance of power utilities at different stages of reforms may be very insightful and interesting. There was a lack of such type of comparative analysis in the literature. This study has been expected to bridge this gap.