CHAPTER II

PUBLIC ENTERPRISE PRICING IN THEORY AND PRACTICE:
POWER UTILITIES EXPERIENCE

Public enterprises play an important role in the Indian economy. Public sector enterprises encompass many heavy and basic industries as also public utilities such as electricity systems, transport networks, water, telephone, telegraph communication, urban mass transportation, etc. and provide basic services essential to daily life.

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. 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

1. Garfield Paul J. and Wallace F. Lovejoy Public Utility Economics, 1964. p.2. Prentice-Hall, Inc., New Jersey. The definition of public utility, however, widely varies from one country to another. For instance, furnishing gas to the industry is considered as a public utility service in France, not in Germany. A classical situation prevails in U.S.A. where it is often argued that a public utility service may be sold by a private firm.
inflation of operational cost because of overstaffing of workers and white-collard 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.²

In this chapter a brief review of 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. Brief conclusions are given towards the end.

I

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 an 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.³

Besides these static allocational and distributional functions, price mechanism serves in various ways to provide incentives to economic growth. According to the welfare school, the maximisation of national income will be achieved through the mechanism of supply and demand on the assumption of perfect competition and of small changes per unit of time.⁴

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. The function of the price system in economic planning is two fold. Prices serve as means of accounting, namely, for evaluating cost of production, value of output and comparing the two. For this purpose, it is necessary to have a proper price system which reflects the social cost (and in the short run the scarcity) of the various means of production and the social importance of the various products. Without such a price system, cost accounting would not have any objective economic significance. This is one major role of the price system. The other role is that of inducing people to do the things required of them in the plan. 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.

Despite the institutional differences, and differences in the stated aims and objectives of various public enterprises in the same country and across countries, many economists have advocated the application of general principles of economic theory to pricing in public enterprises. The most important contribution in this direction has been that of the welfare economists. However, before various theories for public enterprise pricing are reviewed, it is proposed to discuss the theoretical basis and intricacies of price policies for efficient allocation of resources. The analysis is then modified with a view to meet certain other socio-economic objectives in relation to the developing countries like India.

Pricing for Efficient Allocation of Resources:

Economists generally contend that the pricing and investment policies of the public enterprises should lead to an efficient allocation of resources in the economy and that some prices allocate better than others; specifically, that marginal-cost pricing produces an efficient allocation of resources. The allocation of resources means a particular distribution of inputs among various commodities in the production process and a distribution of commodities among various consumers in the exchange process. An efficient
allocation means that no redistribution of inputs can increase the output of any product without decreasing the output of at least one other commodity and also that, given a particular distribution of income, no redistribution of commodities among the consumers can improve social welfare without decreasing the welfare of at least one person.

Resource allocation is generally a matter of general equilibrium analysis. If more of a good is to be produced, with a given amount of resources at society's disposal, less of other goods will be produced. Thus the optimal level can be determined only in relation to other commodities.

Two approaches have been followed by the welfare economists achieving an optimum allocation of resources. The first is the Paretian Criterion in the general equilibrium framework for achieving efficiency in resource allocation. The main value judgements underlying the Paretian Model, no doubt, have been questioned and the weaknesses underlying some of its crucial technical assumptions have been exposed. The second approach involves maximisation of consumers' plus producers' surplus. This approach is used in partial equilibrium framework and can be shown to be a particular case of the first approach. Economic theory does provide a rigorous theoretical framework to decision makers for some of the problems relating to the development of economically efficient pricing policies when considered in a partial equilibrium set up.

The Paretian Criterion:

Paretian welfare economics is based on a set of value judgements.

(i) Pareto's measure of social welfare stems from the basic value judgement that, for the community as a whole, a change which makes at least one person better off, without making any individual worse off constitutes an improvement in the welfare of the group; conversely if some are made worse off and none better off, then group welfare diminishes. Situation B is better than situation A, if at least one individual in the economy is better off at B than at A and no one is worse off.

(ii) Pareto's ordinal social welfare function, 
\[ W = W(u_1, u_2, \ldots, u_n) \] where \( W \) is the social welfare function and \( u_1, u_2, \ldots, u_n \) represent the level of welfare for each of the \( n \) individuals, has two distinct features. First, the utility indices are ordinal and second each level of welfare is uniquely determined given the utility level for the rest of the group.

(iii) Pareto's third value judgement made him believe that each individual, being the best judge of his own welfare, should be left to determine his own welfare, so that a person is better off in situation 'B' than in situation A if he prefers B to A. Here choices and preferences are assumed to coincide.
These value judgements avoid paternalism and rule out interpersonal comparison. Given the initial resource allocation A, if it is possible to find another allocation B at which someone is made better off and no one worse off, then B is called Pareto preferred to A. Suppose a change is made to B and it is found that there is no other reallocation which is Pareto preferred to B, then B is called Pareto optimal resource allocation. In Pareto-optimality, interpersonal comparison is ruled out. Pareto optimality will be achieved when the welfare of even one person cannot be further increased without decreasing the welfare of at least one person in the society. Thus, Pareto optimality becomes a problem of constrained maximisation with the utility of one person maximised and utility functions of other persons serving as a constraint.

Paretian economics, cast in the framework of a stationary state, assumes universal perfect competition in which all consumers aim at maximizing their satisfaction and all producers are expected to maximize their profits. As the available resources are so allocated that the system reaches an overall Paretian optimum, it simultaneously fulfils the optimality conditions for both the production and exchange of goods.

Exchange Optimum

In the Paretian model, optimality in exchange is reached when all possible redistributions of commodities among consumers will make at least one person worse off. Such a position reaches when the marginal rate of substitution (MRS)
between, say, a pair of commodities (xy) becomes equal for all consumers who consume both goods. This means that for any two products X and Y and any two consumers 1 and 2, consumer 1's marginal rate of substitution of X and Y (MRS\textsubscript{xy}) must be the same as that of Consumer 2, that is, to both the consumers, the ratio of the marginal utilities of the two products must be the same.

\[
\frac{\mu_x^{(1)}}{\mu_y^{(1)}} = \frac{\mu_x^{(2)}}{\mu_y^{(2)}}
\]

In the Edgeworth diagram framework, Pareto optimal solutions are represented by the contract curve.

Production Optimum
This refers to the productive efficiency in the allocation of several inputs. The Paretian condition for the efficient allocation of inputs among outputs can be similarly fulfilled if it is not possible to reallocate inputs so as to increase the output of any commodity without at the same time reducing the output of some other commodity. An efficient use of any two inputs i and j in the production of outputs X and Y requires that

\[
MRTS_{i,j}^X = MRTS_{i,j}^Y = \frac{mp_i^X}{mp_j^X} = \frac{mp_i^Y}{mp_j^Y}
\]

Where:
MRTS is the marginal rate of technical substitution and mp is the marginal physical productivity of its input in producing commodity X.
This means that for productive efficiency in the allocation of several inputs the marginal rate of technical substitution of inputs i and j should be the same in all the lines of production and it should be equal to the ratio of the marginal physical productivities of inputs i to j for different products.

**Overall Paretian Optimum**

The necessary condition for the overall Paretian optimum (Optimal relative Outputs) is produced when the point for exchange optimum is combined with production optimum. This leads to the development of the Pareto Optimal condition which fulfils both the necessary and sufficient conditions for optimality in resource use. If resources are to be allocated optimally between any two outputs x and y, then the marginal rate of substitution between x and y and for every individual j = 1,2,.....m, who consume some of the each good must be equal to the ratio of the social marginal cost of production of these two goods. That is, one must have:

\[
\frac{m_u^i}{m_u^j} = \frac{m_u^q}{m_u^p} = \ldots \ldots = \frac{m_u^m}{m_u^n} = \frac{m_c^x}{m_c^y}
\]

The marginal cost of X \((m_c^x)\) may be interpreted to mean the value of the resources needed to produce an additional unit of x.

If the above three conditions/theorems are satisfied, the system will be Pareto optimal. The theorem of invisible hand states that under perfectly competitive market conditions, optimising behaviour on the part of consumers and
firms lead to an efficient (Pareto optimal) social output. 7

Under perfect competition, the above conditions imply that price should always be equal to the marginal costs in all the sectors of the economy for Pareto optimality to operate. 8

Further, when the balance between exchange and production optimum is accompanied by the assumption that the supply of factor input is inelastic, the optimum condition for the use of resources requires that prices of all goods and services sold in the economy become proportional to their respective marginal costs.

It has already been pointed out that the basic postulates of paretian value judgements have been disputed. Even if one ignores it, a fundamental weakness of this analysis is that it is based on a given distribution of income which is taken as satisfactory and so implicitly justified. Thus the above theory advocates the status quo, The Paretian approach can be considered to be welfare economists' instrument par excellence for the circumvention of this issue. 9

Total Surplus Maximisation

The partial equilibrium framework is convenient at the operational level. Here welfare economists advocate maximisation of the sum of consumer plus producer surplus i.e. the total surplus. The notion of willingness to pay and also consumer's surplus go back to the engineer named Jules

9. Baumol, op.Cit., p.503
Dupuit.\textsuperscript{10} He pointed out that the value of a given unit product is more than what the user actually pays for that unit. Willingness to pay may be taken as an index of marginal utility derived from the consumption of that unit of the product. Hotelling\textsuperscript{11} reviewed Dupuit's ideas. He articulated the basic case for using area under the demand curve as a surrogate for consumer benefits associated with consumption.

If $P = p(q)$, then $\int_{q_0}^{q} p(q) \, dq$ will give the total benefits which Dupuit called utilite'. The above expression is the area under the demand curve. Dupuit defined consumer's surplus as a difference between what consumer may be willing to pay for a given amount of a good and the actual price paid by him. This is the area between the demand curve and the horizontal line indicating the price paid for the commodity. The producer's surplus may be defined as the total revenue minus the area under the marginal cost curve.

In the diagram, consumer's surplus is given by the area AECBA and producer's surplus is CFBC minus ECDE. Thus, total surplus (TS) is the area ADCFBA.

Now


Total surplus = Willingness to pay - Total cost of supply

\[ p(q) \cdot dq - c(q_0) \]

where \( p(q) \) is the inverse demand function and \( c(q_0) \) is the total cost of supplying \( q_0 \) units of product.

In general, TS is maximized when,

\[ \frac{d}{dq}(TS) = 0 \quad \therefore \quad p(q_0) = \frac{dc(q)}{dq} \quad \text{where} \quad q = q_0 \]

In particular, if the supply is in competitive price taking situation, output \( q_0 \) will satisfy

\[ p_m = \frac{dc(q)}{dq} \quad \text{where} \quad q = q_0 \]

Where \( P_m \) is the market price.

Thus maximization of total surplus implies marginal cost pricing.

The Marginal Cost Pricing

In the standard textbook, marginal cost is defined as a first order derivative of the total cost function. The total cost function may be defined as a minimum cost of producing the given level of output at a given set of prices. It is considered to be continuous, single valued and monotonic function of output. In the production process, if some factors are assumed to be fixed, the function is called a short-run cost function. If all inputs are variable, the cost function is designated as a long run cost function. The production function underlying these cost functions is assumed to be linear, homogeneous and technologically innocent.
The welfare economists believe that marginal cost pricing leads to the fulfilment of optimum conditions of economic welfare. They argue that "when the output of each product is of such a size that the price fetched just covers the marginal cost, then there will be no further possibility of increasing consumer's benefit by switching factors from one use to the other. The optimum distribution of resources will be reached if each line of output is adjusted to the size at which price equals marginal cost.\textsuperscript{12}

Besides difficulties and arbitrariness in defining short-run or long-run marginal costs, the assumptions of the marginalists viz. perfect competition, perfect knowledge and foresight, perfect divisibility and mobility of resources are too rigorous to be realistic.

It is recognised that, under decreasing-cost conditions, marginal cost pricing would result in a deficit, which would have to be offset by a subsidy financed through taxation of the service or the general public (the solution proposed by Harold Hotelling, 1938). While it is true that optimum resource allocation theoretically can be achieved with marginal cost pricing, the income-distribution effects caused by the subsidy and tax aspects are not neutral. Any subsidy to the enterprises is quite likely to lead to laxity and inefficiency in their management. The rule of marginal-cost pricing, as applied to decreasing cost public enterprises (called the Rule) has been further criticised because it fails

to provide any rational investment criterion. The criterion that the new investment should be undertaken if the total surplus (sum of expected consumers’ and producers’ surpluses) exceeds the expected costs of the project eludes objective measurement. 13

In the wake of these criticisms, modified versions of the marginal cost pricing principle have been suggested in the form of two-part or multi-part tariffs and the club principle.

**Two part tariff**

The two-part tariff, as suggested by Coase, consists of a fixed sum (determined on the basis of some formula) to cover the fixed costs and marginal energy cost to cover the operational costs. The two-part tariff thus covers full costs of the service, avoids losses, leads to an optimum allocation of resources, provides a check against excessive investment and leads to ideal consumption by those who can pay the fixed charges.

The assumption of the two-part tariff that it is possible to allocate clearly common overhead costs between the various products and buyers is difficult to achieve in actual practice particularly when the fixed costs are common to several services. Therefore, some arbitrary discrimination inherent in the method is bound to lead to cross-subsidy and redistribution of income. In order to avoid

the difficulty of discrimination, the 'club' principle has been suggested. According to this, all the members of the 'club' voluntarily decide upon different contributions from members so as to cover the total fixed charges and to achieve voluntary redistribution of income. But this assumption lacks scientific reasoning and is at best a value judgement.14

In the two-part tariff method, those consumers who cannot pay the fixed charge are excluded, and these are generally the poorer sections of the community. If, of two strongly competing industries, one can exploit a multiple tariff and the other cannot, the first may be overdeveloped relative to the second. Thus the marginal cost pricing principle, two-part tariff and the club-principle fail to determine ideal output of the products of public enterprises in the decreasing cost industry.

The Marginal Cost Pricing and The Theory of Second Best:

The application of the Marginal Cost Pricing Rule to public enterprises, irrespective of their cost conditions, is constrained by several limitations. Once the assumption of perfect knowledge is dropped and the risk and uncertainty brought in, the Rule is robbed of its ability to lead to ideal output. The existence of external economies and diseconomies in production and consumption render it a useless tool for maximisation. The assumption of perfect competition is quite unrealistic. Therefore, if prices are

equal to marginal costs in public enterprises operating in imperfect situation and are determined at a higher level under monopolistic competition, the Paretian optimum is not achieved. There is no theoretical justification for a policy of marginal cost pricing, unless adopted universally.

The term 'second best' is applied to an economy in which at least one of the assumptions defining the first best (perfectly competitive market) is violated. Modern economies particularly mixed economies are often beset with monopolies and oligopolies. All economic agents, facing market imperfections arising from the element of monopoly, external economies and uncertainty etc., have to take current decisions in the light of incomplete information about the future policies, tastes and technological possibilities. Consequently, prices are so adjusted that they usually diverge from their marginal costs of production. The theory of second best, in simple terms, holds that public enterprises can achieve optimal price solutions by making their ratios of prices to marginal cost deviate systematically from the relevant price marginal cost ratios established for industries in the private sector. The rules of second best, however, assume that the distribution of real income is not the concern of a public enterprise. Second, the theory assumes that the consumers behave rationally. Third assumption is that either the utilities do not cause any externalities in the course of their operation or the impact of externalities is too trivial to be taken note of. In the end, there is the problem of getting the information
necessary to produce a second best solution. The theory of second best, despite these constraints, provides a suitable framework for examining the problems of putting marginal cost pricing into practice.

Kahn\textsuperscript{15} has suggested the possibility to adapt the Rule to conditions of imperfect competition. To achieve a Paretian optimum in an imperfect market, prices, instead of being made equal to marginal costs in every direction, should be made proportional to marginal costs everywhere. The necessary condition for the attainment of the optimum solution was that prices should bear the same ratio to marginal costs for each firm and each industry in the market. This implied free entry and a uniform degree of imperfection in each industry.

In the real world where imperfections abound and externalities prevail, the first best solutions are not attainable. The rules of marginal analysis at best can be used for generating the second best solutions. These solutions are piecemeal attempts at solving economic problems and analyzing issues in a partial equilibrium setting.

The Paretian model, which seems to have provided rather a rigorous framework for justifying the application of the rules of marginal analysis cannot be applied in the real world. The value judgements on which the Paretian model is based have been consistently falsified. The theory of the second best has demolished even the theoretical basis of the proportionality thesis embodied in the modified Rule of Kahn

\textsuperscript{15} R.F. Kahn, "Notes on Ideal Output," Economic Journal, 1932
and Meade. Lipsey and Lancaster argue that...

It is well known that the attainment of a Paretian optimum requires the simultaneous fulfilment of all the optimum conditions. The general theory of second best optimum states that if there is introduced into the system a single constraint which prevents the fulfilment of one of the Paretian conditions, the other Paretian conditions, although still attainable, are, in general, no more desirable. In other words, given that one of the Paretian optimum situation can be achieved only by departing from all the other Paretian conditions. The optimum situation finally attained may be termed as a second best optimum because it is achieved subject to a constraint which, by definition, prevents the attainment of a Paretian optimum.

Economists agree that it would be impossible to apply the principle of marginal cost pricing in an imperfect market but they still see considerable merit in applying it to some specific sectors of the economy. The theory of the second best, however, shows that welfare may not increase by fulfilling first order optimum conditions in some of the sectors. That their approach is based on dubious arguments becomes clear from the following:

It should be obvious...that the principles of the general theory of Second Best show the futility of 'piecemeal welfare economics.' To apply to only a small part of the economy welfare rules, which would lead to a Paretian optimum if they were applied everywhere, may move the economy away from, not toward, a second best optimum position. A nationalised industry, conducting its price-output policy according to the Learner-Lange 'Rule' in an imperfectly competitive economy, may well diminish both the general productive efficiency of the economy and the welfare of its members. 18

But then this raises the question of whether at the policy level, all departures from the optimum conditions are to be viewed as being of equal importance. The purpose of

18. Ibid
pricing rule is that it should provide consumers with as much information as possible about the resource effects of their consumption decisions so that the costs to the consumer of his consumption decision reflect the cost of the enterprise.\textsuperscript{19} Davis and Whinston\textsuperscript{20} have suggested that one need not take note of non-optimal pricing of those enterprises which are remotely related to the enterprise under consideration. They advocated piecemeal approach. We need to consider prices of complementary and substitute goods only. Some economists have advocated that the deviant sectors (characterised by features such as non-price market competition for expanding the areas of their markets, maximizing sales and, if possible, achieving maximum profits, product differentiation for promoting relative inelasticity for promoting relative inelasticity in the demand for their products etc.) should be directly influenced to follow a rational pricing policy rather than to regulate public enterprise to achieve that end.\textsuperscript{21} The effect of revenue constraints have been examined by Ramsay,\textsuperscript{22} Rees,\textsuperscript{23} Baumc

\begin{itemize}
\item \textsuperscript{19} Michael G. Webb, \textit{Pricing Policies for Public Enterprises} (Macmillan, London, 1976) p.43
\item \textsuperscript{22} P. Ramsay, 'A Contribution to the Theory of Taxation' Economic Journal Vol.37, 1927, pp.47-61.
\item \textsuperscript{23} Ray Rees 'Second Best Rules for Public Pricing' Economica, Aug. 1968
\end{itemize}
Bradford\textsuperscript{24} and Turvey.\textsuperscript{25} Despite numerous conceptual limitations and difficulties in measurement there is a consensus on this point that marginal cost pricing is most desirable if some efficiency has to be achieved. Some new theoretical developments will be discussed later in the chapter.

Some Recent Developments in Marginal Cost Pricing

To operationalise marginal cost for pricing purpose, it needs to be seen in its dynamic setting. Boiteux\textsuperscript{28} and Turvey\textsuperscript{29} have made significant breakthrough in this direction. Boiteux incorporated technological change by evolving concepts of total expenditure curves and development cost functions.

There has been a protracted debate whether price should equal short-run marginal cost or long-run marginal cost. Here the contributions of French economists working in Electricité de France (EDF) are significant. They resolved the confusion between short run and long run marginal cost by supplementing the discussion of marginal cost pricing with the theory of investment planning.\textsuperscript{30} It was established that if optimal investment planning is followed, when the plant is perfectly divisible and there is a continuous equilibrium, the price which is set equal to short run marginal cost will simultaneously equal long-run marginal cost. Investment in

\begin{itemize}
  \item \textsuperscript{24} W.J. Baumol and D.F. Bradford, 'Optimal Departures from Marginal Cost Pricing' American Economic Review
  \item \textsuperscript{26} Ray Rees, Public Enterprise Economics p.39
  \item \textsuperscript{27} Banmol op. cit., p.294
  \item \textsuperscript{28} M. Boiteux, "Peak Load Pricing" in J.R. Nelson ed. Marginal Cost Pricing in Practice (Prentice-Hall, London, 1964)
  \item \textsuperscript{29} Ralph Turvey, "Marginal Cost" Economic Journal June, 30.
  \item \textsuperscript{30} J.R. Nelson (ed)., Marginal Cost Pricing, op. cit.
\end{itemize}
additional capacity is worthwhile if the incremental social benefits exceed the incremental social costs. It may be noted that choosing an investment programme by maximisation of net present value of social benefits is, in the first best economy, exactly equal to choosing an investment programme by marginal cost pricing. The investment rule implied in marginal cost pricing is that if price is used as a rationing device, when market equilibrium price exceeds long run marginal cost, new investment is socially desirable.

Another question relates to the base to which price should be related when industry is out of equilibrium. Both Turvey and Boiteux have argued that price should signal to the consumer the resource cost of supplying additional unit of the commodity. By this logic, price should equal long run marginal cost even in the disequilibrium situation. If long run marginal cost price leads to excess capacity, still price should be made equal to marginal costs so as to avoid distortions in resource allocation, although there is a real possibility of some loss of consumer surplus. If marginal cost pricing leads to scarcity, physical rationing may be preferred to rationing by price and additional investment be made. Consumers make purchases on the assumption that the relative prices of substitutes will be mainained and the existing price structure will continue. So, frequent price

31. Ray Rees, Public Enterprise Economics. op. cit., pp.48-49
33. Webb, op. cit., pp.24-28
changes may be resented and may eventually be harmful.

Indivisibilities pose another problem of their own. Williamson has shown that in the presence of indivisibilities, the optimal capacity is not found by equating price simultaneously with short run and long run costs. In general, if there are indivisibilities, the optimal price will either exceed or fall short of long run marginal cost. Thus, the enterprise will be either incurring losses or making profit. However, if additions to the existing system are small in comparison with the existing system, indivisibility does not pose any serious problem as the cost curves may be assumed to be smooth curves.

Crosland’s Solution to Public Enterprise Pricing

According to Crosland, a modern nationalised industry is in the nature of a multi-plant industry operating under oligopolistic competition, facing considerable competition and cross elasticity of demand. He divides public enterprises into two categories, those producing homogeneous goods and those producing non-homogeneous goods. In the former group, price is fixed by the Central Authority so that supply equates demand. The managers of the individual plants equate their marginal costs to this price and maximize their profits. The marginal plant, which would be the highest cost plant, would either earn normal profits or abnormal profits or run at a loss signalling the Central Authority to expand

or contract the industry. In case the products of various plants are not homogeneous, prices would be fixed by the managers themselves by equating marginal cost with price of each product. In nutshell this means applying market rules of pricing to the public sector.

Crosland's modified version of marginal cost pricing in public enterprises has been criticised on the ground that equating marginal cost to prices in each plant need not mean a maximum utilisation of the plant capacity. Also, there is the danger that the managers would exploit their monopoly position in the short-run and earn intra-marginal units rent in the long-run. The sole aim of public enterprises' is not to achieve profit maximization. The normal market signals may not, therefore, provide the best solution for public enterprise pricing.36

Average Cost Pricing vs Marginal Cost Pricing:

Since marginal cost pricing in its pure form cannot be put into practice, public enterprises adopt average cost pricing, surplus generation, annual payments, target setting as alternative methods of pricing in actual practice. The main merit of average cost pricing is that it is considered less expensive and more attractive to administer than other techniques of costing and pricing. Second, average cost pricing enables the enterprise to cover its full costs and spares the community the burden of the additional taxation that may become necessary to make any losses caused by charging the marginal cost price in the case of decreasing

36. G.S. Bhalla op. cit
cost industries. Further, the method avoids monopoly exploitation of consumers in those increasing cost industries which charge marginal cost pricing. Average cost pricing is based directly on the projected actual book costs over a time period. Consequently, it provides the management with a rough criterion for its investment policy. But surely marginal cost provides a forward looking base for pricing the products while average costs are essentially historical.

The main danger of a fully distributed average-cost (FDC) pricing system is that it may hide the inefficiency of an enterprise and force the consumers to pay the full costs of an obsolete or high cost plant by removing the incentive for innovation. Moreover, average cost pricing is said to fail in achieving optimum allocation of resources. It may thus cause economic distortion. Still, the average cost pricing is one of the most popular methods for pricing in public sector industries because it is precise, verifiable, equitable and administratively easy to manage.

Average cost pricing, no doubt, has its own merits and demerits. However, proper prices can only be fixed after the criteria for efficiency has been designed for each enterprise. Target setting, surplus generation and annual payments are methods of pre-determining in the light of the specific conditions prevailing in an enterprise and the exact rates of return expected from it each year. The possibility of blending marginal cost pricing signals with a judicious use of the principle of averaging for achieving economic efficiency in public enterprise pricing needs, however,
deeper probe. These attempts may lead only to the second best solutions but in any case there is no single rule for public enterprise pricing that can automatically lead to optimum allocation of resources and welfare maximisation.

II

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.

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
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.

The monopolistic nature of electric utilities enables them to practise price discrimination in suitable cases. The objectives of differential pricing of utility services are:

(i) to enable the utility to sell a volume of service which will maximize the utilisation of its plant and equipment;
(ii) to achieve thereby the lowest average unit costs of operation; and

(iii) to afford the utility the best possible opportunity of earning the desired/stipulated rate of return. Differential pricing enables the utility to balance fiscal objectives with welfare objectives which may be conflicting to a certain extent.

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.37

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

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 interconnections 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.

The load factor is defined as the ratio of the average load to the peak load. In a public utility enterprise, characterized by high fixed costs, the importance of the load factor may be assessed in cost terms. The higher the system load factor, the lower the average unit cost of service. The diversity factor is defined as the ratio of the sum of the class peak demands to the system maximum demand. The higher the diversity factor, the lesser the total plant capacity
required to serve a particular market or service area. A high diversity factor helps to offset the economic consequences of the low load-factor customers which form an important part of the market for electric service. Improved diversity is one of the principal economic benefits of the consolidation of a number of electric utilities.

When the costs of electric utilities are analyzed, it is found that: (a) some costs are a function of the total number of consumers; (b) some costs are a function of the volume of service supplied; and (c) some costs are a function of the service capacity of plant and equipment in terms of capability of carrying hourly or daily peak loads. Accordingly, an established procedure for analyzing public utility costs provides for the assignment or distribution of total costs among three categories on the basis of the characteristics suggested above. These cost categories are: customer costs, energy costs, and demand and capacity costs. Customer costs include the expenses of meter reading, billing, collecting and accounting and the costs associated with such property of the utility as metering equipment and service connections. Energy costs include, for the most part, the expenses for fuel, fuel handling, and part of power plant operating and maintenance expenses. Demand or capacity costs consist of all or most of the plant-related costs, such as return on rate base, principal taxes, the annual depreciation accrual and certain expenses of operation and maintenance.
Objectives of Electricity Pricing

The modern approach to electricity pricing recognizes the existence of several objectives or criteria, not all of which are mutually consistent. First, national economic resources must be allocated efficiently, not only among different sectors of the economy, but also within the electric power sector. This implies that prices that reflect cost must be used to indicate to the electricity consumers the true economic cost of supplying their specific needs so that supply and demand can be matched efficiently.

Second, certain principles relating to fairness and equity must be satisfied, including: (a) allocating costs among consumers according to the burdens they impose on the system; (b) assuring a reasonable degree of price stability and avoiding large price fluctuations from year to year; and (c) providing a minimum level of service to persons who may not be able to afford the full cost.

Third, the power prices should raise sufficient revenues to meet the financial requirements of the sector. Fourth, the structure of electric power tariffs must be simple enough to facilitate the metering and billing of consumers. Lastly, other economic and political requirements must also be considered. These might include, for example, subsidised electricity supply to certain sectors to enhance growth or to certain geographic areas for regional development.

Since the above criteria often conflict with one another, it is necessary to accept certain tradeoffs between them. As already discussed the LRMC approach to setting
prices is both rigorous and flexible enough to provide a tariff structure that is responsive to these basic objectives.

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 costs, should form the basis of pricing. Today, energy is very expensive. The pricing policy that is followed is a very crucial parameter, simply because if electricity is provided too cheaply, this will overstimulate 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.

Pricing must be future-oriented. If oil prices go up significantly, electricity costs will follow this long-run tendency. If utilities don't set prices to tell consumers what it will cost to generate electricity in the future, they are misled. Utilities are also misleading industrial people because they may set up plants that use a lot of electricity under the mistaken belief that electricity is cheap, whereas if utilities had given them the right price signal, they would have gone to some other form of energy.

Another aspect that needs emphasis is that for public utilities cost of supply should not be the only factor to be taken into account. Utilities ought to go beyond that and also look at the impact of quality of supply on consumers and the costs of power shortages imposed on society. Utilities have to minimize not only the system cost but also the total social cost i.e. the cost of power failures to the customer.

There is a general agreement that prices based on historical or accounting costs are inadequate as signalling device. The economists argue that prices should reflect incremental or marginal costs and thus provide the correct
signals for the consumption changes. Secondly, economists are now generally agreed that the accounting approach is inadequate for purposes of efficient resource allocation. Their argument is that accountants are concerned with the recovery of historical or sunk costs, whereas resource allocation emphasises the actual resources saved or used by every consumer decision. Bygones are bygones. Historical costs have no relevance to decisions which are made today, which involve resources in the present or in the future. Turvey and Anderson state as under:

The backward-looking estimate of the traditional approach creates the illusion that resources... are as cheap or as expensive as in the past. On the one hand, this may cause over-investment and waste; on the other, it may lead to under-investment and unnecessary scarcity. In addition, if the past holds a number of poor projects, the sunk costs of mistakes, if reflected in prices, will overstate the costs to the consumer of extra consumption, which is not efficient... For efficient resource allocation, prices should be related to the resource costs of changes in consumption; i.e. pricing according to marginal, not average, cost. The change in the cost to a consumer of altering his electrical behaviour will then mirror the change in the cost to the enterprise.

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.

Prices should reflect essentially the current cost of using electricity at the specific time. Despite criticism against it, marginal cost, still provides a consistent and rational basis for deciding the appropriate price differentials for fixing prices by time of use. The main purpose of marginal cost pricing is not to level load but to charge right price. If price reflects cost then the right load curve reflects what customers want and are willing to pay for. If demand is responsive to price, there will be some response to time-of-use prices resulting in the load shift. The resultant demand pattern is economically efficient.
France, Britain, Sweden and some other European utilities are among those where principles of marginal cost pricing have been applied in tariff making in recent years. France has been the pioneer in this regard. During the past decade and a half, public utility commissions in the United States have been influenced by this approach, though they have been much behind Europe in this regard. Several States in USA have strongly suggested that electric utilities submit 'peak load' price structures based on marginal cost principles. The application of the theory, of course, has been modified substantially in practice.

**Application of Marginal Cost Pricing**

Given the available information on demand, production costs, and taking into consideration the costs of metering and administering a complex pricing system, different approaches have been suggested for applying the basic theory of marginal cost pricing to construct time-of-day and seasonal prices in the case of electricity.

**The American Approach:**

Assuming homogeneous production capacity this approach simplifies the problem of allocating joint production cost by identifying a 'strong' peak period and a 'weak' off-peak period - that is where the peak does not shift when prices are raised in the peak period and lowered in the off-peak period. The general principle is that peak users should pay marginal operating plus marginal capacity costs and off-peak users should pay only marginal operating costs. The existence of shifting peak complicates the calculation of the
efficient prices, since it requires information about both the costs of production and the positions of the relative demand functions so that the demands in these periods are equalized and the marginal capacity cost is exactly covered by the prices during these periods. The social welfare function underlying this solution of allocating marginal capacity costs according to the intensity of demand in each of the equilibrium peak periods calls for maximizing net benefits defined as total revenue plus consumers' surplus less opportunity costs, on the assumption that individual gains and losses are weighed equally to whomever they may accrue.

The British Approach

This approach, as developed by Turvey, assumes a fixed load duration curve. The emphasis here is on the calculation of long-run marginal costs of providing services to meet a fixed set of demands in the context of a heterogeneous production technology and the optimal utilization of the technical possibilities. The identification of peak and off-peak periods depends on both the fluctuations in demand and the fluctuations in capacity availability due to planned and unplanned outages.

Theoretically it may appear that the problem of allocating joint capacity cost has been solved by the specification of heterogeneous technology, and the assumption of fixed load duration curve. Turvey, however, completely ignores the shifting peak problem and thus provides no insight as to how long run marginal cost should be converted.
into actual practice.

Green Tariff and Peak Load Pricing: The French Approach

Electricité de France devised a tariff structure during the fifties popularly known as the Green Tariff. The theory developed by Marcel Boiteux is based on the principle of sale at marginal cost. Assuming a constant demand for electricity in the first instance the following two rules have been arrived:

(i) Electricity should be charged for at a price equal to the short-run marginal cost of supplying it at the point where demand equals price;

(ii) The capacity of the plant should be expanded when short-run marginal cost is above the long-run marginal cost and contracted otherwise.

This implies that if an optimum investment policy is followed, short-term pricing will be long-term pricing. For determining least-cost investments in electricity supply, French have used marginal analysis for comparison of fossil and hydro alternatives to meet a given demand for electricity.

The French approach has tried to establish a relationship between pricing policy and investment policy in the context of the efficient operation of a public enterprise.

The demand for electricity varies over the daily as well as seasonal demand cycles. In such a situation it is not technically feasible to vary the capacity to optimal size because electricity, being non storable, has to be produced instantaneously to meet the demand as and when it arises. In
such a situation, enterprise needs to evolve a pricing policy which will ensure fuller utilisation of the existing capacity at off-peak as well as peak periods and also ensure that the installed capacity is of appropriate size. As the demand at peak periods is different from off-peak hours, one can assume that the enterprise is facing two distinct demand functions. The problem of peak load pricing gets reduced to the problem of allocation of joint cost which arises due to indivisibilities of the installed capacity.

The French approach has tried to analyze these considerations and have attempted to incorporate them into the methodology for determining actual electricity tariffs. The suggested rule for dealing with the problem of varying load is simple enough. According to the theory of Green Tariff, the total costs (both operational and fixed) of supplying electricity should be recovered from the consumers. The consumers demanding electricity during the peak period should pay the entire fixed cost in addition to their share of the operating costs, while the rest should pay only the operating costs. The rule is then generalised for more than two time periods.

Besides being periodic, electricity demands are highly uncertain. At times, therefore, demand may exceed available capacity resulting in curtailment of loads. Uncertainty of supply due to forced outages is also there. These

uncertainties cause curtailment costs which have implications for both investment planning and pricing. On the investment side capacity should expand up to the point at which the cost of an additional unit of capacity is equal to the expected marginal curtailment cost. On the pricing side prices should be equal to expected marginal energy costs plus expected marginal curtailment cost for each relevant demand period.

To meet the supply and demand uncertainties electric generating systems require reserve margins. French have given special consideration to the transmission and distribution systems, investment in which may be as much as 50 per cent of total investments. While generation and transmission systems are treated as 'Common system and the system load characteristics are treated as same for both of them for determining peak load prices, the distribution costs are analyzed separately based on the demand characteristics of small group of customers which would not necessarily be coincident with system demand patterns.

Others have also suggested similar approaches to deal with the problem of demand uncertainty. If demand is uncertain, disturbance term may be introduced in the peak as well as off-peak demand functions. Brown and Johnson have established that if income distribution aspect is not taken into consideration appropriate price policy is that which clears the market when demand is at its lowest peak position. This will require rationing at other higher peaks. If

quality of service is also to be considered, the provision may be made explicidy in the demand function.

The problem of uncertainty may be solved by determining the optimal size of the capacity margin. In the plant a margin of additional capacity may be kept to meet unforeseen breakdowns or higher demands. Given the firm's estimate of the probability distribution of future demands, it will weigh up the cost of an addition to inventory. One may expect to end up roughly at a point at which the cost of the marginal additions to inventory is just equal to the cost of expected loss of not making the addition to the margin. In other words, when extra cost of increased reliability is equal to the probable cost of the inconvenience caused by the shortage, the reserve margin is adequate.

The uncertainty may manifest in the cost function also. In electricity industry, it may be taken into consideration by introducing fuel adjustment clause in the tariff to ensure that fuel price changes are reflected in price as well.

Theory of Peak Load Pricing: Other Contributions

Peter Steiner⁴² made a distinction between firm peak and shifting peak cases. He concluded that if the peak is firm, once the appropriate capacity is determined, the output in each period should be extended to that capacity unless additional units of outputs fail to cover the operating cost.

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41. Ray Rees, op. cit., p.147
42. P.O. Steiner, "Peak Loads and Efficiency Pricing"
The above analysis suggests that in the off-peak periods, the price should equal running cost whereas at peak period, it should equal long-run marginal cost. If price equal to long run marginal cost leads to shortage, capacity should be expanded. If peak itself is shifting and not firm, then price elasticity of demand during peak and off-peak periods will have to be taken into account. Hirshleifer accepted Steiner’s model and simplified it by giving a diagrammatic presentation. The solution for shifting peak case involves differential pricing according to the relative strength of the demands for the output per sub-period. Since the cost of supply is joint to both sub-periods, new investment is worthwhile so long as the sum of the differences between price and the operating cost per period exceeds the cost of providing a new unit of capacity for the demand cycle. The above analysis relates to only two equal duration periods. Williamson has generalised and extended above analysis to any number of equal duration periods. He has cast his model in general equilibrium framework and provides welfare motivation to his model.

The analysis of the peak load pricing problem has been extended in many directions. Michael Crew and Paul Kleidofar treat simultaneously periodic demand, diverse technology, demand uncertainty and rationing costs in a consistent framework for determining both efficient prices and an optimal investment plan. They establish that the optimal price in each period should be equal to the expected marginal operating cost plus expected rationing cost. In
reality, demand cycle does not typically divide itself into two or three distinct parts but consists of demand changing every moment. In such a situation one has to decide about the number of sub-periods to be included in the price structure. The choice will have to take two things into consideration. Firstly, the cost of implementation and administration and secondly, the ease with which consumer can appreciate the price policy. Though demand may not be uniform during each sub-period, one price will have to be charged which may be the average for that period. No general rules can be laid down to solve this problem. Recent developments in electricity supply reliability, pricing and system planning emphasise the close interrelationships among these aspects.

Marginal cost pricing is a central concept in economic theory. However, various approaches given above indicate that the application of marginal cost pricing principles to the actual calculation of prices is considerably more complicated than simple pricing models may indicate. Considerations of demand elasticity, uncertainty, rationing costs, heterogeneous technology and other complications of an actual supply system can help to extend the basic principles to incorporate additional considerations that reflect reality more accurately.

44. Williamson op. Cit.
It may thus be concluded that the review of literature on public pricing suggests that for efficient allocation of resources price should have a relationship with marginal cost. In actual pricing, modifications required by the nature of the enterprise and uncertainty may also be incorporated. If any consumer class has to be subsidised on the social grounds the financial burden should be borne by the State Government and not by the public enterprise.

**Peak Load Pricing in Practice**

Peak load pricing has been in practice in some countries despite its attendant costs of complexity. When France introduced marginal cost based pricing in 1956 peak load tariff was applied only to high voltage consumers. Five different daily rates were introduced for each of the six voltage levels of supply. After a year the national load curve was noticed to have flattened out at the peak to the extent of approximately 5 per cent. This meant a reduction of 300 MW of peak demand and considerable saving of fuel and foreign exchange. The total economy (including investment on transmission and distribution which also depend on peak demand) was estimated at more than 50 billion francs for seven years following introduction of the new tariff. Over the years the daily load curve has flattened out considerably, but the shape of the yearly load curve has deteriorated. "There is a transition in the electricity supply system from a peak of a few hours a day during a good

46. Webb, op. cit., p.40
many days a year, to a system whose peak corresponds to a large number of hours the same day, but only during a few days a year, but at dates which cannot be foreseen. The seasonality of electricity demand has increased significantly because of a change in the pattern of working hours resulting in a lower growth of consumption during the summer. Electricité de France continues to apply marginal cost pricing. The new tariffs are based on demand rather than voltage. Since the nature of peak problems has changed completely, the new system proposes a "Peak Day Withdrawal Option" which is expected to enable the EDF to tackle the new peak problem effectively.

Among newly industrialised countries Korea has recently tried to implement peak load pricing. The results of the enforcement of the peak load tariffs by Korea Electric Power Corporation (KEPCO) indicate that the peak ratio (ratio of peak load to average load) has come down from 127.3 before the introduction of peak tariffs to 119.7. The off-peak ratio at night, increased from 79.5 to 85.7. KEPCO has estimated a possible saving of US $ 250 million in new investment as a result of peak load pricing.

Generally, the electric utility industry in India, largely under the control of the State Electricity Boards,  

has certain common features of their tariff structures. Most of them have a two-part tariff (demand charge as well as energy charge) system for the industrial high voltage tariffs, and tariffs consisting only of energy rates for domestic, commercial and other categories of small consumers. An examination of the tariffs in the present day utilities shows that they are much below long-run marginal costs in most categories. Electricity tariffs are below even average costs, of supply in some of the major categories, such as agricultural pumpsets. The Committee on Power, generally known as the Rajadhyaksha Committee, recommended in its report in 1980 that all the Electricity Boards should try to introduce differential prices for non-peak load and peak load demand by consumers. It has also recommended that the peak hour tariff should reflect the cost of incremental additions to capacity. The Government's intentions to introduce peak load pricing by Electric Undertakings are clear from the discussion paper on Administered price Policy, 1986 which states as under:

The tendency to favour uniform prices has led to the neglect of efficiency considerations in the pricing of electric power. At present our electricity tariffs do not, generally, vary with time of day or season, yet the present pattern of demand for electric power is characterised by systematic variations according to the time of day. This leads to the need for heavy investment in capacity to meet peak demand, even though such

50. Ibid.
capacity remains largely underutilised at off-peak periods. The introduction of peak load pricing (under which electricity at off-peak hours is provided at a much lower price than at peak times) will induce a more even pattern of demand over the day and thus reduce the need for fresh investment in capacity. Of course, the shift to peak-load pricing of electricity will require one-time investments in new meters. But this additional expenditure will be far outweighed by the savings in investment that may be expected as a result of a more even pattern of electricity demand.

In India some state utilities e.g. Gujarat have very recently introduced limited form of peak load pricing by offering some off-peak concessions. But the effect of this is yet to be seen.