ANALYSIS OF THE FLORIDA PUBLIC SERVICE COMMISSION
RATE DEPARTMENT'S RECOMMENDATION
REGARDING RATE STRUCTURES

Docket No. 73694-EU

Prepared for
Joint Select Committee on Utility Rate Structures

January 15, 1975

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In its Recommendation, the Public Service Commission Rate Department has outlined a general procedure and philosophy of electric utility rate structures. Prodded by legislative actions and consumer pressures, the Recommendation is timely. Careful examination and consideration of alternatives has characterized utilities nationally in recent years; numerous policy-oriented proposals have been offered in the public utility literature in reference to needed changes in electric utility rate structures.[1] Florida has long needed an effort for the formulation of rate structure policy, but the environment of the electric utility industry has, until recently, resulted in the PSC staff channeling its activities into fighting "brushfire wars" with few resources remaining for the development of long-range policy. On the other hand, had it not been for the energy crisis, the need for prescriptive policy would not have been readily apparent. Here we analyze the Rate Department's Rate Structure Recommendation with respect to both content and implementation.

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[1] See, for example, Haskell P. Wald, "The Theory of Marginal Cost Pricing and Utility Rates," Public Utilities Fortnightly, June 22, 1967, and "Recent Proposals for Redesigning Utility Rates," Public Utilities Fortnightly, September 13, 1973; Herbert B. Cohn, "Should Utility Rate Structures be Revised to Discourage Electric Use?," Public Utilities Fortnightly, April 11, 1974; Barbara Epstein, "A Proposal to Modernize Electricity Tariffs," Public Utilities Fortnightly, August 30, 1973; William G. Shepherd, "Marginal Cost Pricing in American Utilities," Southern Economic Journal, XXIII, July 1966; and Alfred E. Kahn, The Economics of Regulation: Principles and Institutions, I, Chapter 3, "Marginal Cost Pricing," New York: Wiley, 1970.

Beginning with efficiency criteria, the Recommendation states that "rate structure should 'track' costs." The principle that <u>price should reflect costs</u> is at the core of efficient resource allocation. As Bonbright states:

> Rates should be designed to discourate the wasteful use of utility services and promote all use that is economically justified in view of the relationships between costs incurred and benefits received.[2]

Stated another way, rates should act as a proper signal upon which individual consumption decisions can be made. Costs must, of course, include all costs--those that are directly measurable, such as fuel, as well as social costs, such as effects on the environment.

Turning to the <u>conservation of energy</u> issue, the Recommendation asserts that rate structures should not be designed to artificially restrict consumption, just as they should not promote uneconomic consumption, i.e., consumption where the costs are greater than the benefits received. When rates reflect costs, informed consumers should be able to intelligently determine whether or not the satisfaction gained in purchasing an additional unit of electricity is worth the sacrifice of other goods and services. A rate which is above cost will result in an unnecessary under-utilization of resources, while a rate that is below cost will result in an over-utilization of resources. One caveat that might be added here is whether consumers are fully informed regarding the energy costs of operating various appliances and devices. On the other hand, the costs of information provision activities could outweigh the benefits stemming from more informed consumption choices, so benefit-cost tradeoffs must be recognized here as elsewhere in public policy.

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[2] James C. Bonbright, <u>Principles of Public Utility Rates</u> (New York: Columbia University Press, 1961), p. 292.

Inverted rates have been proposed to reduce consumption, and the Rate Department concludes that inverted rates are not an acceptable form of utility pricing. We agree. The first two justifications for inverted rates cited in the Recommendation [that is, (1) the need for restriction of consumption through raising the per-unit price of additional consumption and (2) that large users should, in the interest of equity, face proportionately higher bills as their consumption increases] are, as the PSC staff pointed out, not grounded in economic principle. The Recommendation also rejects a third rationale for rate inversion: the assumption that, as a customer's rate of consumption increases, so does the average cost of supplying his service. We find some merit in this argument, since inflation in construction costs and higher costs of capital have caused the long-run average cost of production to turn up more rapidly than would otherwise be the case. That is, promotional (or declining block) rate structures are not appropriate for periods of rising average cost as consumption increases. In addition, to the extent that higher levels of individual consumption represent demands made at the peak of the system, those higher levels of consumption should be assessed higher rates. But the policy of peak load pricing is not rate inversion per se, rather it follows the fundamental principle of price reflecting costs.

Despite this issue of rising average costs, we agree that inverted rates are no panacea, and indeed could exacerbate the situation. First, it can cause significant revenue reductions; second, it would encourage small users of electricity to consume more electricity. As the Recommendation later states, incremental cost pricing brings about the most efficient allocation of costs to consumers.

It should be noted that the allocation of customer and energy costs is an extremely difficult task. It is easy to determine customer billing costs, since such costs may be divided evenly among the total number of customers. An economically justified allocation of other customer-related costs is not always a simple task, however, and the Recommendation might have delved more deeply into this problem. For example, the costs of meter reading and the return to and depreciation of distribution facilities (neither of which varies with consumption nor with the timing of consumption) are not equal for all customers. These costs are density dependent; that is, these costs decline as the density of customers increases. Rural customers necessitate higher components of customer costs than do their urban counterparts. On the other hand, rights-of-way and underground wires may increase some components of distribution costs for urban service. Appropriate cost allocation can be done and will improve resource allocation in the energy area, but it will require significant time and effort. The PSC has apparently requested that firms begin to handle costs in this manner.

The Recommendation states that <u>energy costs</u> "vary directly with kilowatt-hours generated." The statement should read as follows: "Energy costs vary directly with kilowatt-hours generated <u>at any specific point in time</u>." Electric utilities do not rely on one type of generating plant. Their more capital-intensive base load plants (nuclear, oil, or coal fired) are operated continuously, while their more fuel-intensive plants (diesel or gas turbine) are operated at peak periods when demands made on base load capacity are at excess levels. Thus, energy costs at off-peak periods, when only base load generators are in operation, are smaller than energy costs at peak periods, when fuel-intensive generating units are started up. Thus, the timing of consumption affects energy costs, although, as will be noted later, metering technology is not yet capable of measuring hour-by-hour changes in energy costs, nor is it financially practical.

As the Recommendation states, the most difficult cost allocation problem is demand (or capacity) costs. Costs associated with capacity (i.e., fixed operation and maintenance expenses and return and depreciation on generation and transmission facilities) are common costs. The technical definition of common costs is that one part of total capacity does not serve one set of customers, but rather all capacity serves all customers making demands on the system. Numerous methods of allocating these common capacity costs have been utilized. The non-coincident peak method has probably found the widest use in practice, but the economic rationale behind the method is questionable. The coincident peak method, advocated by Davidson[3] and others, is the most economic of all methods, but its application is quite difficult in practice. We are faced, therefore, with a tradeoff between efficiency and practicality.

Under the non-coincident peak method of allocating capacity cost, the maximum rates of consumption of all customers or classes are summed irrespective of the timing of consumption to arrive at the aggregate "non-coincident demand." Capacity cost is allocated to each customer class according to the ratio of the classes' maximum rates of consumption (regardless of time) to the aggregate "non-coincident demand." Such a method of allocating capacity costs is inefficient because an individual, whose maximum rate of consumption occurs off the system peak, has an incentive to shift a portion of his consumption to the peak period, so his peak demand falls, which reduces his capacity charge but which necessitates increased capacity!

[3]Ralph K. Davidson, "The Problem of Allocating Capacity Cost," Land Economics, XXXII, No. 4, November 1956, pp. 334-356.

Under the coincident peak method, customers are assessed capacity costs according to the ratio of their consumption at the system peak to aggregate system peak consumption. The rationale underlying this method is that system capacity is determined by the rate of consumption at the peak; that is, the level of capacity must be sufficient to meet demands made at the peak of the system. Purely off-peak customers (to the extent that such a class exists) do not place a burden on system capacity and, as such, are not causally responsible for capacity costs. Capacity exists regardless of individual off-peak consumption patterns.

As mentioned earlier, the coincident peak method of allocating capacity costs possesses some problems of practicality. Sufficient metering technology is not available to measure all customers' consumption rates at peak periods. Other problems occur when customers respond to capacity charges by creating a new system peak at a previously off-peak period (called the shifting peak). For example, under the coincident peak method, it is advantageous to an individual to consume at an off-peak period, since, in so doing, he avoids a capacity charge. It does not follow, however, that it is advantageous to the system for all customers to shift their consumption patterns from peak to off-peak periods. The complex pattern of possible substitutions at different times illustrates the problem of "solving" once and for all the allocation of capacity costs. The implementation of peak load pricing (discussed later) would, however, more closely approximate an efficient allocation.

The PSC recommendation stresses the central importance of setting price equal to marginal cost for efficiency. Marginal cost is the cost incurred in producing one more unit of output or, conversely, the cost savings realized by reducing output by one unit. As the Recommendation states, marginal cost pricing can be fully demonstrated to be efficient only if the prices of other related products are also equal to marginal cost. Where there are divergencies--for example, in the case of a substitute, like natural gas--careful consideration should be given to the optimal relative prices of the substitutes, compared with their marginal costs of production and delivery and the relative demands for the goods.

A further qualification of marginal cost pricing, which was not covered in the Recommendation, is the absence of external effects. Externalities are benefits ("external economies") or costs ("external diseconomies") which are not reflected in the market price. An example of an external diseconomy is air pollution, which imposes costs on those who must experience its effects. Unless those who are inconvenienced by a firm's air pollution are compensated by the firm (or abatement equipment is installed to mitigate the pollution), the price of the commodity will not reflect the full social costs of producing the commodity. Determining the optimal level of abatement again involves equating the incremental benefits (reduction in inconvenience and associated health hazards) with the incremental costs of the equipment. But this is an area where the Department of Pollution Control, rather than the PSC, has primary jurisdiction.

In a competitive market, marginal cost pricing occurs automatically. The question is how to simulate this result in the regulation of utility services. First, long-run rather than short-run marginal cost seems to be the best basis for pricing since, in the long run, capacity may vary, and long-run marginal cost describes the cost of adding an additional unit of output (produced in the most efficient manner). Furthermore, as a practical matter, long-run incremental (rather than marginal) cost pricing is more realistic since incremental cost refers to the cost of adding a finite block of output, as opposed to an infinitely small amount of output.

As noted in the Recommendation, long-run incremental cost may be above or below average historical cost (including depreciation, etc.). Regulation must somehow provide revenues sufficient to cover current costs and returns to investors (reflected in historical costs). In a case in which long-run incremental cost pricing provides revenue greater than cost, a rate structure may be devised to lower revenues without substantially increasing consumption. On the other hand, if long-run marginal cost pricing does not provide revenue sufficient to cover costs, rates to some customer classes may be increased according to relative price elasticities of demand of various customers.

Price elasticity of demand is a measurement of the proportional change in quantity demanded as a result of a change in price. A relatively price-elastic demand for electricity is one in which a small percentage increase in price brings about a relatively large percentage reduction in quantity demanded. On the other hand, a relatively price-inelastic demand for electricity is one in which even a large percentage increase in price brings about a relatively small percentage reduction in quantity demanded. Studies of the demand for electricity have measured a greater price elasticity of demand for commercial customers than for residential customers and an even greater price elasticity of demand for industrial customers.[4]

Consider the case in which long-run incremental cost pricing of electricity does not provide revenue sufficient to cover costs. In the absence of direct governmental subsidy, the utility must raise prices to some customers; but which customers will receive the price increase? Industrial customers

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[4]See, for example, Stephen J. Baron, "An Econometric Model of the Demand for Electricity in Florida," Masters thesis, University of Florida, August 1974.

(whose demands for electricity are relatively price elastic) will respond to a price increase by cutting back demand by a relatively large proportion. The possibility of generating electricity themselves exists, and energy-intensive firms may be mobile enough to move elsewhere, or certainly not to expand production facilities. Thus, raising prices to industrial consumers would reduce total revenues and would not likely mitigate the situation. Residential customers (whose demands for electricity are relatively price inelastic) would respond to a price increase by reducing their demands by a relatively small proportion. Revenues would increase, and costs would, in this fashion, be covered.

Unfortunately, little is known concerning the price elasticity of demand at peak periods. The cost allocation most frequently associated with peak periods relates to capacity costs. Thus, little is known of the responsiveness of peak demand to changes in the methods of capacity cost allocation.

We concur with the Recommendation that peak load pricing, to the extent that feasible metering technology is available, should be a goal of public utility regulation in Florida. Under peak load pricing, demands made at peak periods should be made to bear the responsibility for costs incurred in meeting those demands. As mentioned earlier, the technology is not available for properly assessing peak load responsibility of all customers. As a first approximation to peak load pricing, seasonal rate differentials, reflecting both higher capacity and energy costs at peak periods, could be imposed. As the PSC recommendation emphasizes, an approximation of peak load pricing will provide better signals to consumers of electricity in that it reflects the cost differentials of various consumption patterns. To the extent that the demands of some customers are relatively price elastic at peak periods, peak load pricing should cause significant readjustment in consumption patterns from peak to off-peak periods. The Recommendation was quite correct in emphasizing that, due to rising prices and higher capital costs, customers should not associate peak load pricing with lower rate levels. However, it should mitigate the need for additional future capacity, and thus reduce costs relative to what they would have been otherwise.

The residential rate schedule recommended by the PSC consists of both a flat monthly customer charge and a two-step declining kilowatt-hour charge representing demand and energy costs. It is important to note that the flat monthly customer charge should represent all customer costs involved in the provision of electric service, regardless of either the level of consumption or the timing of consumption. Certainly if the fixed monthly customer charge did not reflect all customer costs involved in providing electric service, there would be a degree of subsidization among the utility's customers. The two-step declining kilowatt-hour charge representing demand and energy costs appears to be appropriate given the level of existing metering technology. As has been noted earlier, metering technology is not sufficient at present to facilitate a pricing system which reflects the full peak load responsibility of residential customers. Controlled-usage appliances could indeed make it possible to promote off-peak usage and thereby reduce peak period demand. Such appliances utilize a timing device whereby consumption is restricted during on-peak hours.

We concur in the view that a seasonal rate differential should be implemented into the residential rate schedule. Such a measure would not necessitate the addition of new metering facilities but would, rather, be implemented through computerized billing systems which are already in existence.

We further agree that rate discounts to "all electric" customers should be abolished. Although the purpose of "all electric" rate schedules is to provide discounts for high customer load factors, such a pricing scheme should not be considered a panacea for the simple reason that a residential customer's peak demand, which enters into the customer's load factor, may not occur simultaneously with the system peak demand. A technique of pricing which more closely approximates peak load pricing would better promote off-peak consumption and thereby reduce peak period demand.

The PSC's classification of commercial and industrial customers into "general service - non-demand" and "general service - demand" categories is appropriate. No doubt such categories would have arisen regardless of the PSC Recommendation, as utilities are already beginning to base their customer classifications on consumption patterns rather than on the business nature of the customer.

The recommended rate schedule for general service - non-demand customers consists of a fixed monthly customer charge and a two-step declining kilowatt-hour charge. The fixed monthly customer charge should cover all customer costs involved in providing electric service. As in the recommended residential rate schedule, the two-step declining kilowatt-hour charge would reflect both energy and demand (or capacity) costs. The demand component of the general service - non-demand schedule will exceed that of the residential rate schedule due to the relatively greater demands placed on capacity by a typical general service customer as opposed to a residential customer.

The "general service - demand" classification of customers includes those commercial and industrial customers whose consumption is measured on a demand and watt-hour meter. All customers' consumption is measured on watt-hour meters. Demand meters measure the peak demands of individuals and, thus, facilitate the measurement of peak load responsibility. The three-part rate schedule proposed by the PSC would include a fixed monthly customer charge, a flat energy charge, and a demand (or capacity) charge based on the maximum number of kilowatts demanded.

We concur in the view that discounts for <u>interruptable service</u> are unwarranted to the extent that the probability of interruption is low. To provide rate discounts for such service when, in fact, curtailment does not occur is uneconomic and results in some cross-subsidization by other customers. A credit for peak period curtailments would be a more logical provision.

In conclusion, we find the Public Service Commission's Rate Structure Recommendation to be economically sound and administratively feasible. Minor qualifications introduced here are generally to clarify the intent of the Recommendation.

Addition to Analysis of ... Recommendation
Regarding Rate Structures

In response to the PSC Recommendation on rate strucutes, a report was submitted to the Public Counsel outlining potential deficiencies in the Recommendations.[1] The Report provides an extremely useful summary of the Recommendation and expresses concern over possible inherent conflicts in policy. We will attempt, at this point, to react to the Report as a means of fully critiquing the PSC Recommendation.

The major criticism presented in the Report clearly follows the argument that relatively new approaches to the pricing of electricity (i.e., marginal or incremental, as opposed to average, cost pricing) are overly concerned with spreading all costs without proper regard to the relative burdens borne by utility customers. As such, the Report contends that the "new systems of cost analysis" prevent the public from understanding "the full impact of commission decisions."[2] In essence, the Report criticizes the PSC Recommendation as espousing the economic principle of efficiency (price reflects cost) at the expense of the principle of equity ("fair" distribution of revenue burdens).

The Report to the Public Counsel in no way belittles efficiency in rates. What is emphasized is that there exists definite trade-offs between efficiency and equity in the pricing of electricity (<u>or any good</u>, for that matter). "If reasonably broad and meaningful policy objectives are set," states the Report "more than one method (of cost analysis) will be needed."[3]

1Ben Johnson "Electricity Pricing and the Public Interest," Report to the Public Council, January 15, 1975.

[2]<u>Ibid</u>, pp. 2-3.

[3]<u>Ibid</u>, p. 7

In addition to the use of many cost analysis methods, the Report contends that the PSC should concern itself with the relative impacts of various pricing methods on individual customers.[4]

The Commission must, to a certain degree, be concerned about the impact on (and, therefore, the response of) individual customers as a result of rate structure changes. Such a consideration should be secondary, however, to the provision that price reflects cost. As the Recommendation states:

> Any government fiscal measure has the effect of redistributing income, and we do not consider that the legislature of the State of Florida intended for that responsibility to be exercised by the PUblic Service Commission.[5]

We concur in the opinion that it is <u>not</u> the proper function of a utility regulating agency to make policy decisions explicitly concerning the distribution of income. Again, legitimate concerns regarding the relative burdens borne by individual customers should not be disregarded. To subsidize certain groups of consumers by maintaining artifically low prices for electricity should not, however, be a policy of regulatory commissions. Instead, direct assistance programs should be adjusted for these groups of consumers, in the event that relief is deemed justified.

The Report to the Public Council states three primary policy objectives which should be adopted by the PSC: praticality, efficiency, and equity.[6]

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[4] <u>Idem.</u>

[5] "Recommendation: Rate Department Investigation, Docket No. 73694-EU,"

[6] Johnson, <u>op cit</u>, pp. 10-14

The importance of the objective of practicality cannot be disputed. Rate structure policy should indeed be concerned with such criteria as the avoidance of excess or insufficient profits, the minimization of administrative costs, the maximization of acceptability and the minimization of unpredictability and instability of revenues and profits. As we have substantially stated elsewhere in this analysis, the policy of efficiency in rates should, to the extent possible, be closely followed. The policy of equity in rates, as mentioned above, is indeed an important aspect of rate determination. At the PSC level, however, any trade-offs between equity and efficiency should be decided in favor of the latter. To the extent that, in some cases, an efficient allocation of costs cannot be determined, one might incorporate equity considerations at this stage.

The primary concern stated in the Report is that the PSC Recommendation does not directly address itself to the question of what objectives the PSC should attempt to meet and what policies and tools should be used in achieving those objectives. The Recommendation does suggest, however, that the objectives of <u>efficiency</u> in rates should receive top priority. Furthermore, the policy designed to achieve this objective is clearly stated: "rate structure should track costs." There is only one method of cost analysis which will implement that policy -- long-run incremental cost. The Report notes that "many (particularly certain academic economists) will argue that equity is to be dismissed as a matter of little or no concern ..."[7] Certainly equity <u>should</u> be a matter of concern. It is our opinion that equity should be dealt with <u>directly</u> at the root of the problem and not indirectly (through manipulation of the price mechanism) by means of subsidization between classes of

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[7] Johnson, p. 35

customers or between present and future customers.

The Report expresses concern over the "apparent deviation from cost analysis" inherent in a portion of the Recommendation.[8] In particular, issue is taken with the statement that "costs that do not vary in the short run should be assigned on a basis other than cost."[9] The Report construes this as meaning an arbitrary allocation of fixed costs. A long-run incremental cost basis of allocation is not, however, an arbitrary method.

The Report describes in great detail various flaws regarding the rationale behind the declining block structure of rates. It is further stipulated that a flat or an inverted rate structure may be a more reasonable pricing alternative. We agree, for the most part, with the Report in regard to the deficiencies of the declining block schedules. We are not convinced, however, that a flat or an inverted rate structure would be more appropriate than would an approximation to incremental cost pricing through such means as peak load pricing. The PSC Recommendation in no way supports the continuance of declining block structures.

With regard to peak load pricing, the Report states that the definition of peak and non-peak periods is a policy decision and that a conflict of objectives will arise in making such a decision.[10] We find it difficult to agree with this statement. The definition of a peak or non-peak period is based

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[8] Ibid. p. 34

[9] Recommendation, op. cit, p. 1.

[10] Johnson, op. cit, p. 37

on scientific observation, and it is not clear that in defining such periods a conflict of policy will arise.

The Report makes note of the fact that, as a determinant of public policy, one should weigh the benefits (through lower prices) accruing to an individual's shift from peak to off-peak consumption against the losses (in terms of inconvenience) stemming from such a shift.[11] It should be noted, however, that such a shift would not occur unless the cost savings to the individual exceeded the cost of his inconvenience. Certainly a commercial or industrial customer, in shifting a portion of his consumption from peak to off-peak periods, will realize a significant degree of inconvenience, possibly reflected in higher wages to employees as an inducement to work during less desirable hours. Unless the increase in wages exceeds the reduction in the price of electricity, the industrial or commercial customer will shift his consumption because, in so doing, he is operating his business at the greatest efficiency. The customer was previously facing a lower price, reflecting the fact that he was previously being subsidized by other customers. Through peak load pricing, a customer faces the true costs of his consumption and, thus, receives the proper pricing signals upon which he may base his consumption patterns.

The Report concurs with the PSC Recommendation that, to the extent that technology is available and financially feasible, time-of-day metering should be implemented. If such technology is not financially feasible, the Report proposes that, in the interest of equity, time-of-day metering should be made available to any customer who is willing to pay the incremental cost of providing it. We agree that, to the extent that the additional benefits accuring to the implementation of time-of-day metering exceed the costs realized by the individual in providing the necessary technology, the customer stands to gain.

The problems associated with allocating customer, energy, and demand (or capacity) costs are properly described in the Report to the Public Counsel. We agree with the contention that the allocation of these costs is not a straightforward procedure. To the extent possible, we advocate a functionalization of costs on the basis of economic principles of efficiency. This approach would not involve such procedures as averaging customer costs within customer classes, but rather would attempt to differentiate between relative cost responsibilities of more homogeneous groups of individual customers. Certainly, if an "ideal" cost allocation procedure was followed to an extreme, the costs involved in the allocation process <u>per se</u> would offset any efficiency gains.