

AD-A095 439

RAND CORP SANTA MONICA CA

F/G 5/3

GATHERING INFORMATION ON COSTS OF SERVICE: SOME BASIC CONSIDERA--ETC(U)

OCT 79 J P ACTON, F CAMM, D MCKAY

UNCLASSIFIED

RAND/P-6422

NL

[OF]
AD-A095 439



END
DATE
FILMED
3-81
DTIC

LEVEL

1

AD A095439

6
GATHERING INFORMATION ON COSTS OF SERVICE:
SOME BASIC CONSIDERATIONS FOR IMPLEMENTATION OF PURPA

10 Jan Paul/Acton; Frank/Camm, Jr.; Derek/McKay

DTIC

FEB 24 1981

11/ Oct 79

12/21

DBC FILE COPY

DEFENSE PLANNING A
Approved for release
Distribution unlimited

14 RAND/P-6422

8 2 13 111

The Rand Paper Series

Papers are issued by The Rand Corporation as a service to its professional staff. Their purpose is to facilitate the exchange of ideas among those who share the author's research interests; Papers are not reports prepared in fulfillment of Rand's contracts or grants. Views expressed in Paper are the author's own, and are not necessarily shared by Rand or its research sponsors.

The Rand Corporation
Santa Monica, California 90406

1

GATHERING INFORMATION ON COSTS OF SERVICE:

SOME BASIC CONSIDERATIONS FOR IMPLEMENTATION OF PURPA

Jan Paul Acton, Frank Camm, Derek McKay

P-6422

October 1979

RECEIVED
FEB 24 1981
C

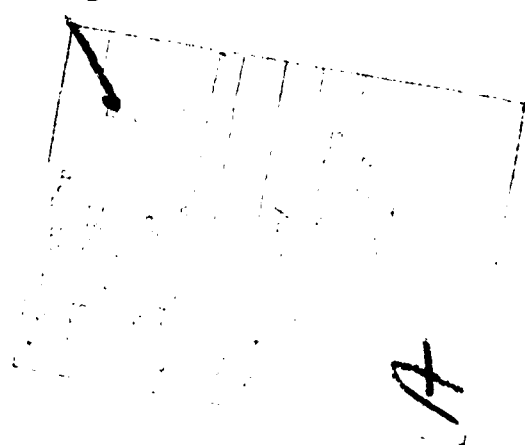
DISTRIBUTION STATEMENT A
Approved for public release;
Distribution Unlimited

PREFACE

In the period following the passage of the Public Utility Regulatory Policies Act of 1978(PURPA) the Federal Energy Regulatory Commission was responsible for the generation of a number of procedural rules to implement the Act. An earlier version of this paper was submitted to F.E.R.C on January 10, 1979 in response to a request from F.E.R.C. for ideas about the collection of data under Sec. 133 of P.U.R.P.A. Only minor changes have been made to the original version which reflected our views at that time.

There has been a significant program of research underway at Rand on Utility Issues sponsored by contracts from the U.S. Department of Energy, the Los Angeles Department of Water and Power and the Electric Power Research Institute. Part of this work has concerned the measurement of marginal costs in an operating utility and how to implement rate structures based upon marginal cost. It is upon this experience that the views and recommendations contained in this paper are based.

Over the next several years, policy analysts will be critically examining the workings of PURPA, and this paper should be of interest in light of the final form that the FERC regulations took.



SUMMARY

The Public Utility Regulatory Policies Act of 1978 (PURPA) requires that the Federal Energy Regulatory Commission collect various data on costs of service from utilities. The exact methodology of collection was left largely up to FERC. In this paper we make some specific recommendations on the way this data collection activity should be arranged.

In view of the costs of collecting, storing and disseminating large amounts of data, we recommend that only demonstrably useful data is collected. Further, FERC should consider sampling techniques in order that unnecessary costs are not imposed on utilities. In addition, the possibility of synchronizing these data collection activities with ordinary rate hearings should not be overlooked.

Considering the processing time which FERC's predecessor agency, the Federal Power Commission, seemed to require to publish much smaller amounts of regularly collected data, great attention should be given to the mechanics of the collection process. Where possible standard formats and machine readable documents should be required.

We recommend that careful consideration be given to the need for collecting much of the traditional accounting cost categories. The intent of PURPA in Sec. 115(a)(2) seems to definitely emphasize the need for economically based marginal costs information. Marginal cost information is difficult to collect in a standardized form and careful analysis of the methodology and accuracy of the collected data will be

→ required. It is this difficulty that makes collection during regulatory hearings attractive as the assumptions behind the cost measurements can be scrutinized.

Finally there would seem to be good reason for FERC to consider collecting interchange data that is consistent with the other data so that bulk power rates can also be analysed.

CONTENTS

PREFACE.....	iii
SUMMARY.....	v
A. Purpose.....	1
B. Principles for Recomendations.....	2
C. Summary of Recommendations.....	3
D. Development of Recommendations.....	5
I. Requirements for cost data under Sec. 115 and 133 appear to be inconsistent.....	5
II. Actual hourly data from a recent year on incremental operating cost would promote a better understanding of utility costs.....	7
III. Sampling can play an important part in the collection effort.....	10
IV. Tying data collection for FERC to data requirements of individual rate cases allows the collection of significantly more detailed data for a given cost.....	12
V. Reliability, as an important component of electric utility output, is a basic determinant of system cost.....	13

A. PURPOSE

The Public Utility Regulatory Policies Act of 1978 (PURPA) requires in Sec. 133 that the FERC establish rules for reporting certain new measures of costs associated with providing electric service. Sections 111 and 115 require that state regulatory commissions consider new standards for electricity ratemaking, including time-of-day and seasonal rates based on changes in costs due to certain changes in the amount of energy delivered. Other sections require analysis of extending power pooling, wheeling, interconnection, and greater cogeneration of electricity.

The implementation and evaluation of these and other provisions of PURPA require collection of some new types of data. Traditional cost accounting data, often based on accounting conventions and historic values, are not adequate for many of these purposes. Existing research at Rand (as well as related research at other organizations) and our contact with some California electric utilities through the Marginal Cost Pricing Project (being run by the California Energy Commission and the California Public Utilities Commission), has convinced us that certain measures of the marginal, or incremental, cost of service are vital to the implementation of these provisions. This paper briefly outlines some of the types of data that we believe would assist in the implementation of PURPA. Please note that the recommendations were prepared under a very short lead time and should not be treated as the definitive results of extended research. They are subject to amplification as research proceeds and as discussion takes place over

proposed FERC guidelines.

B. PRINCIPLES FOR RECOMMENDATIONS

A number of principles for data collection and ratemaking underlie our suggestions. The most important of these is that the cost data collected should measure, to the greatest extent possible, economically relevant costs. In general, this means marginal costs on a forward looking basis rather than historic accounting costs. We believe that the data collection standards should take account of the cost of data collection and balance these against the improvements in ratemaking and benefit-cost analysis that better data make possible. We believe that it is important to judge the feasibility and reliability (or accuracy) of the data that are likely to result from a data collection standard. We feel that to the greatest extent possible, common data should be developed to permit implementation of the various sections of PURPA. We also feel that, to the greatest extent possible, the data collection under PURPA should be consistent with the data developed by utilities for systems operations, for reporting to other agencies, and for use in their regulatory proceedings.

With these principles in mind, we offer several specific suggestions. Our suggestions emphasize the collection of marginal cost data. Measures of short and long run marginal costs assist in the implementation of several sections of PURPA as well as other ratemaking activities. For example, they assist in answering the following types of problems:

- o Information on short and long run marginal costs will help identify distinct costing periods for purposes of designing time-of-day, seasonal, and interruptible electricity rates.
- o Marginal costs will help determine appropriate levels of rates, including rates for customers with interruptible service.
- o Marginal costs will help review power pooling and power exchange arrangements.
- o Marginal cost information is needed for cost-benefit analysis of extending interconnection arrangements and implementing alternative rate structures.
- o Marginal cost information will assist in the design and evaluation of cogeneration arrangements, including the identification of economically appropriate rates for customers who may wish to sell excess energy to the electricity grid.

C. SUMMARY OF RECOMMENDATIONS

In this section, we make six specific recommendations. We justify these recommendations in the next section under five generic headings.

1. We suggest that special care be given not just to what data should be collected, but also to what should not be collected and how to collect the data that are required. Cost, expected accuracy, and ability to verify data easily are important considerations. Two attractive ways to economize on costs are (i) sampling and (ii) coordination of collection efforts with rate hearings. It will probably be appropriate to collect some data on a regular basis, to sample other data, and to collect still other data only during hearings. Objective strategies are available to choose among these options, but they take time and study to develop. At the very least, coordinating the collection of data mandated by Sections 115, 133, and 209 of the Act will reduce costs and utility resistance and probably increase the

accuracy of data collected.

2. We recommend that utilities collect and report on a regular basis hourly measures of (a) ex ante incremental system operating costs (as determined, for example, the day before actual operations) and (b) hourly system load. Initially, these data should be collected in 100 percent samples (8760 hours) for at least some utilities and then may be less completely sampled in other circumstances as costs and other factors indicate. These data should be supplied and made publicly available in computer-readable form.

3. We recommend that provisions be made so that some information will be supplied on (a) ex post hourly system incremental cost (that is, actual incremental costs at time of supply), either with or in place of ex ante measure suggested in (2); and (b) hourly incremental cost of purchased power. Again initial 100 percent samples could be replaced by smaller samples at a later date in some circumstances. These data should be computer readable.

4. We suggest that in conjunction with rate cases, prospective hourly incremental operating costs and system loads for representative time periods be developed and reported. Supporting hourly weather data might provide helpful information but are not absolutely required. Complete description of assumptions underlying the estimated costs is important in the hearing but probably need not enter FERC's data collection effort.

5. We recommend that consideration be given now to the development of standard procedures for measuring and reporting electricity exchanges among utilities. This includes data on reliability, wheeling, and interchanges of electricity. We cannot specify precisely which data are best to collect; the reliability study under Section 209 should yield useful ideas that might be exploited in future collection efforts. The planning likely to be necessary for such collection should start now.

6. We suggest that careful consideration be given to the need for data on traditional cost categories with the objective of reducing or eliminating the reporting of some of these data. This applies particularly where the data involve arbitrary allocation of common costs. Such data are unlikely to aid in ratemaking design to "...take into account the extent to which total costs to an electric utility are likely to change if..." electrical service is increased (Sec. 115(a)(2)). FERC will meet considerable resistance, internal and external, to departing from traditional cost concepts, but the limited resources that FERC and the utilities can bring to this data collection effort should be concentrated where they can do the most good.

D. DEVELOPMENT OF RECOMMENDATIONS

I. REQUIREMENTS FOR COST DATA UNDER SECTIONS 115 AND 133 APPEAR TO BE INCONSISTENT

The cost concepts under Sec. 133(a) of PURPA tend to reflect traditional cost of service notions which are of little use to the formulation of marginal cost-based rates and the conservation of energy

made possible by them. In particular, subsection 133(a)(1) suggests the allocation of common costs among customer classes, a notion of little value to the formulation of rates which properly reflect the economic cost of providing electricity service to a customer. This interpretation should be avoided.

The concepts under Sec. 115(a), on the other hand, appear to be a better basis for measuring relevant costs. They are consistent with the scenario method of marginal cost estimation which has been found feasible and appropriate by a number of electric utilities. The method is now being applied by the Task Force on Marginal Cost Pricing organized by the California Energy and Public Utility Commissions under contract to the Economic Regulatory Administration.

Although not explicitly stated anywhere in the Act, one would expect DOE to want the same costs in both Sections of the Act (115 and 133). This would not only economize on the collection of cost data, but also reduce utility resistance to the provision of such data and thereby tend to increase their accuracy.

One would also expect ratemaking to be the primary activity to benefit from these cost data. Sec. 133(c)(2) requires a utility to submit data to be collected to all state agencies with responsibility for ratemaking; no other agency gets similar treatment except FERC itself. The data prescribed under Sec. 115 are far more useful for this purpose and, to the extent possible, the data to be collected under Sec. 133 should be consistent with the definitions offered in Sec. 115, particularly paragraphs (A) and (B) of subsection (2).

II. ACTUAL HOURLY DATA FROM A RECENT YEAR ON INCREMENTAL OPERATING COST WOULD PROMOTE A BETTER UNDERSTANDING OF UTILITY COSTS.

Incremental or marginal costs measure the economically relevant features of costs in different time periods. In the short run, these cost differences are captured by incremental fuel and labor costs of the marginal generating units. As the time frame extends, incremental maintenance costs, economic value of hydro resources, and energy available from other utilities affect the measurement of system marginal costs. Finally, when new capacity can be added, long run marginal costs include the change in the amounts of capital and operating expenses.

In our experience, under present day circumstances of fuel costs and reserve margins, the most important variations in marginal costs are found in differences in the short run marginal costs associated with different times of the day and seasons of the year. Although they are not complete measures, differences in marginal operating costs capture the bulk of these differences in most circumstances.

A convenient, if imperfect, measure of incremental operating cost is the system lambda used in the dispatch of thermal generating units. If utilities do not already maintain an historical record of system lambda, they could do so very easily. This record is generally an ex ante measurement of system lambda used to plan production (for example, for the next day). We have found an ex post measure of system lambda to be a more accurate economic measure since it reflects important adjustments of production not indicated by the ex ante measure--for example, due to forced outage or start-up constraints. Because this ex

post measure is not typically collected and stored under present practices, the additional cost of requiring this must be weighed against potential benefits.

System lambda does not reflect the incremental operating costs of hydro resources and purchased power exactly, but it will usually be close for most utilities. Purchased power contracts, particularly those in the spot market, are typically tied to system lambda in a systematic way (either ex ante or ex post , depending on the circumstances). The incremental operating cost of a hydro resource is the running cost of the source that would be used if the hydro were not available and this is typically close to system lambda (presumably ex post) as well. If a more exact measure of incremental operating costs for purchased power is desired, an hourly record of the most costly interconnection in each period will be useful. Such data are typically not collected or stored by a utility and will impose additional costs. Equivalent data for hydro resources are not currently available.

We recommend the collection of a full set of 8760 hourly data points for each of the series above for at least a sample of utilities during the first round of collections. These data can be used to define typical daily, weekly, and seasonal patterns of operating cost, data likely to be of interest to (but again, not sufficient for) ratemakers. They will also allow definition of the variation of actual costs around these patterns, also a parameter of interest to ratemakers. Note that variation is not included now among the variables for which data are requested in Sec. 133. As these patterns become better understood,

fewer than 8760 data points will be required in a year to define them and a sampling scheme can be devised to collect relevant data.

Even after patterns are well understood, our understanding of incremental operating cost can be enhanced by knowing the system load during each hour of the sample year. This will allow the ratemaker or analyst to correct for unusual variations in demand for electricity due to weather, the economy, and so on. While specific data on these exogenous factors--for example, degree-hours as a weather indicator--might be of interest, they are not nearly so important as sample data on system load. The cost of their collection should be carefully weighed against benefits expected from the activities in which they might be used. System load data, of course, also allow us to monitor changes in load curves and to impute cost savings from alternative rate arrangements. Persons interested in the measure can also monitor changes in load factors although it is a very crude measure of the economically-relevant variation. Over time, system load data can be sampled just as incremental cost data are.

All of the data we have recommended so far are historical. If ratemaking is the primary application of these data, prospective data are of more interest than historical series. They are also far more costly to generate and more difficult to verify. Cost and verification difficulties will decrease if prospective data are collected as part of individual utility rate hearings rather than on a regular biennial (or other) basis (see Recommendation IV below). In this case, prospective data must be generated anyway and FERC can take advantage of this by

providing a common format in which to collect these data. That format might include projections of representative daily, weekly, and seasonal load curves. Utilities could then selectively perturb sections of these load curves--for example, one hour at a time--and use their system planning models to derive the cost changes that would be associated with such load perturbations (cf. Sec. 115(a)(2)). These cost changes are prospective incremental costs, numbers of great importance to ratemakers. The difficulty of reviewing assumptions underlying such estimates, choosing among sets of estimates, and so on, suggests that such numbers will be more meaningful if they come out of a rate hearing or other forum that allows detailed review. The collection of such data by FERC increases the need for the kind of data consistency discussed in Recommendation I.

III. SAMPLING CAN PLAY AN IMPORTANT PART IN THE COLLECTION EFFORT.

While a 100 percent sample includes data that can be applied to ratemaking and other cost-related analyses of any specific utility, a smaller sample allows collection of a far richer set of data for a given cost to FERC and individual utilities. Many sampling strategies are possible: (a) complete data on a few types of data can be supplemented by detailed data on a few utilities; (b) hourly data can be collected on some types of data from a utility while aggregated data on other topics is collected from the utility; (c) utilities can be selected for in-depth reporting from stratified samples each year or longitudinal samples on a few utilities can be collected year after year.

The best strategy will depend on the way the data are expected to be used, the nature of the data themselves, the importance of accuracy in the data, potential verification of the data, and of course the receptiveness of the industry to alternative schemes. Surely utilities in longitudinal samples, particularly small utilities, would require some assistance or inducement if they are to cooperate fully on any extensive data reporting effort. This is true both because of the costs of reporting (which other utilities would not face) and because the additional data collected and made publicly available would potentially make their rate cases more lengthy and costly. The planning of documents useful to the industry and possible only through the collection of certain data will also reduce resistance to deep sampling; it may also help cull out data requests of little value.

The sampling strategy to be used cannot be chosen easily as it may take some years to plan it. More data should be collected in the first round than are expected to be needed later. This will provide a primary data source which can be used to plan a sampling system which maximizes the information collected for a given cost. The choice of aggregated data that can be collected should proceed in a similar way. Special attention should be given to verification where the primary data are not collected.

These are all obviously broad and general statements. They are aimed at emphasizing the importance of avoiding costs in data collection where possible. Costs to individual utilities should be given as much consideration as those to FERC even though resources devoted to cost

collection within utilities allow FERC to stretch its resources at little cost to itself. Sampling is a logical response to costly collection and one method likely to be an important part of any collection strategy. Another follows.

IV. TYING DATA COLLECTION FOR FERC TO THE DATA REQUIREMENTS OF INDIVIDUAL RATE CASES ALLOWS THE COLLECTION OF SIGNIFICANTLY MORE DETAILED DATA FOR A GIVEN COST.

Sec. 133(c)(2) requires that data collected under FERC's mandate be publicly released any time a utility enters a rate case. And while each utility is required to provide data at least every two years (Sec. 133(c)), the Act does not appear to require that the data be current. It appears feasible therefore to limit the collection of at least some forms of data--and perhaps many--to episodes in which rates change. It allows collection at a time when the data are of particular value to the utility and public utility commission (or its equivalent). This is likely to increase the accuracy of the data, allow better local verification, reduce local resistance to collection, and--if properly supplemented--allow the collection of a much broader range of data, in a more detailed form, than would be feasible in any other way. Prospective marginal cost data are one example of this (see Recommendation II.) Because the primary use of the data is likely to be the formulation and evaluation of proposed tariffs, this strategy collects data when they are most wanted and does not significantly degrade the quality of the data base created. Even if some data are collected on a regular basis, the opportunity of a rate review should be exploited to collect more detailed data and perhaps data of interest

only to the utility involved. Such a strategy, of course, puts a special premium on the compatibility of cost data discussed in Recommendation I.

V. RELIABILITY, AS AN IMPORTANT COMPONENT OF ELECTRIC UTILITY OUTPUT, IS A BASIC DETERMINANT OF SYSTEM COST.

The maintenance of reliability in an electricity supply system is a significant contribution to cost; the cost of providing electrical service cannot be properly addressed without significant consideration of this measure of output. Several factors make this particularly important now. First, increasing interconnection is changing the nature of reliability as perceived by any one utility. The reliability of each utility now depends not only on actions it takes within its own system, but also on the arrangements it makes with its neighbours. Among these arrangements are wholesale rates, rates at which utilities purchase power from one another and hence rates important to the marginal operating costs of a utility. Second, there is increasing interest in the provision of different levels of reliability to different customers, perhaps through interruptible rates (see, for example, Sec 209 (a)(2)(c)). The energy and capital savings associated with interruptible rates can be properly weighed against the value of the industrial output or household well being foregone during an interruption only if interruptible rates themselves reflect these savings. And third, these changes are taking place in an environment where our concepts of reliability are relatively primitive, often defined in terms of overly simplistic rules of thumb. While system

engineers are continually improving their ability to estimate indices of the relative reliability of systems we currently cannot measure the absolute effective reliability created by a given configuration of generation, interconnection, and so on. The reliability study to be conducted under section 209(a) of the Act could both benefit from FERC information collection and provide reliability concepts that would help define data FERC should collect. We urge coordination of these two efforts to assure the proper consideration of reliability in the analysis of utility system costs.

In addition, we can suggest in outline an exercise that might be conducted as part of FERC's data collection effort. The results of abrupt failures in generating plants and transmission lines are typically felt over a wide region. But little is known about who actually picks up the additional load imposed by such failures, that is, who actually ensures the reliability of the regional systems. cursory evidence in Great Britain suggests that the plants which do pick up the load in these circumstances are not always those that one would have expected. The distribution of load pickup does not appear to be consistent with the reliability clauses included in most interconnection contracts. This raises the issue of whether either higher reliability at the same cost, or the same effective reliability at lower cost could be achieved through enforcement of contracts which better reflect the actual costs of providing reliability. FERC's data collection effort provides an opportunity to create a data file that might be used to investigate the effects of major failures and their implications for regional reliability and to reflect the cost of reliability more

accurately reflected in wholesale and retail rates.

Our short lead time has not allowed us to determine the exact data requirements of such an effort. We believe the file should be event-oriented. The changes either in interchange between utilities in a region or in their net system loads associated with an event might be used to infer load distribution. Instantaneous changes would probably require instrumentation not currently installed in all utilities, but grosser measures could be obtained with current equipment and these could potentially be collected as part of the hourly data collection discussed in Recommendation II. Utilities are unlikely to agree to structured experiments, but natural experiments are frequent and provide a rich set of events for study. For example, during 75 days of 1977, the Los Angeles Department of Water and Power (DWP) was affected by 24 major system disturbances in Arizona, California, Oregon, and British Columbia. The average disturbance involved a load rejection of 637Mw (standard deviation of 250Mw) and a change in DWP's net interchange of 101Mw (s.d. of 109Mw). Careful planning would be required before FERC began collection to determine which data are most useful to such a study. But data likely to be interesting clearly fall within FERC's data collection mandate and could be used for related analyses into cost and reliability. Other data, such as historical hourly interchange data, sampled or complete, could also be defended. Further work would be required to determine if their costs justified their collection.

