Competitive Bidding In Electricity Markets: A Survey

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A number of states as well as the Federal Energy Regulatory Commission have been considering whether traditional regulatory regimes in electricity and natural gas markets should be replaced with competitive bidding systems. This shift is designed to yield a more efficient allocation of energy resources within the existing legal framework. The paper examines both the theoretical basis and empirical evidence on bidding processes in light of the characteristics of energy markets, especially electricity markets. It then discusses the extent to which one can draw policy conclusions about designing specific bidding processes for these markets. It concludes that given the underlying complexity of the products involved, the optimal system for procuring power should include a mix of bidding, negotiation and utility construction.

INTRODUCTION

The Public Utility Regulatory Policies Act of 1978 (PURPA) resulted in a considerable number of changes for the U.S. electric utility industry. Both cogeneration and independent power production as sources of electricity have grown since its passage. The issues associated with these supply options include:

- How should utility planning treat cogeneration?
- How should avoided cost be calculated?
- Should prices for power from cogenerators or independent power producers (IPPs) be determined administratively, through negotiation or through competitive bidding?
- How should any price scheme take account of nonprice factors?
- How should back-up rates for standby or maintenance power be determined?

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- What is the appropriate wheeling policy for cogenerated power?
- Should utilities be allowed to offer lower rates to customers willing to forego cogeneration activities?
- Should utilities be allowed to also function as IPPs[1]?

One PUPRA-related development that will have a significant effect on the structure of the electric utility industry concerns proposals to use bidding processes[2] to acquire power. The Federal Energy Regulatory Commission (FERC) has already examined bidding processes for allocating capacity on gas pipelines.[3] FERC now seems to be moving toward capacity brokering (as opposed to bidding) to create natural gas pipeline auction markets. Nevertheless, FERC and many state regulators are expending considerable effort investigating whether bidding should be used to determine the price for power from Qualifying Facilities (QFs) and, possibly, other power producers.[4] At least 20 states have either approved bidding for power or are considering whether to implement a bidding scheme.

The momentum is clearly building to use bidding as a means of acquiring resources. To understand and participate in the debate on bidding and the design of bidding processes, it is important to be familiar with two potentially valuable sources of information. First, the theoretical and empirical literature in economics may offer guidance on the design of bidding processes for power markets. Many interesting research questions emerge on designing bidding processes given the specific characteristics of energy markets. Second, FERC, some state public utility commissions, and individual utilities have either proposed or adopted bidding systems. Reviewing the features of these processes may help regulators or utilities considering the appropriate policy options for their jurisdictions or firms. This paper surveys both of these sources of information.[5]

1. For a more detailed discussion of these questions, see NERA (1988).
2. Bidding and auction are used interchangeably in this paper.
3. Alger, O'Neill and Toman (1987) describe the types of bidding processes FERC considered. Alger (1988), Plott (1988) and McCabe, Rassenti and Smith (1988) describe the results of FERC-sponsored experiments regarding bidding mechanisms for natural gas pipeline capacity.
4. See, for example, "Notice of Proposed Rulemaking: Regulations Governing Bidding Programs," (1988). Recently, the debate on bidding has been expanded to include IPPs, demand side management (conservation) and the utilities themselves. States endorsing bidding usually specify some combination of supply and demand sources (QFs, IPPs, utilities, demand side management projects) to be considered eligible for bidding. Whether to include certain supply or demand sources raises interesting problems, although I will not address those in this paper.
5. A comprehensive discussion of bidding processes in all energy markets is beyond the scope of the current paper. The bidding process in a futures market such as that for oil futures has been analyzed elsewhere. See Rozek and Wu (1987).

BIDDING THEORY

In practice, bidding processes can be very complex. However, the theoretical literature consists of many models in which only one player operates on either the buying or selling side of the market (monopsony or monopoly) and only one unit of the product is bought or sold.[6] When multiple players are on both sides of the market simultaneously making bids and offers, the resulting process is called a double auction. However, it is also the area of bidding theory for which we have few results. Generally, as the complexity of the market setting increases, there is less that we can conclude from existing theory about the relative merits of different bidding processes.[7] However, much of the terminology and many of the issues are relevant to the debate on bidding processes for power markets.

The essential feature of all bidding processes is that the players (buyers and sellers) must be able to make credible commitments; that is, there can be no reneging on a bid/offer or the acceptance of a bid/offer. If there is not a degree of confidence among all players in the bidding process, it will not survive. A key questions is: How should the market be organized to establish this degree of confidence? In the case of bidding for commodity futures contracts, the organized exchanges (Chicago Board of Trade, Chicago Mercantile Exchange, etc.) become a party to all transactions. When a trader buys or sells a contract for future delivery of a product, the resulting agreement is with the exchange itself rather than another trader. This removes the need to locate the particular buyer or seller when the contract is offset with another transaction or delivery of the product must take place. The traders have confidence in the organized exchange; therefore, the bidding process survives in this market setting. In designing a bidding process for QF capacity, it is important to provide potential traders with a guarantee that all other traders will follow the rules and that traders do not have incentives to abandon their contracts. This function may be the responsibility of the state regulatory commissions.

Four types of bidding processes are frequently discussed in the theoretical literature.

(1) Descending-bid auction (English)—the auctioneer (if one exists) or traders gradually lower the price for the product available for purchase until one seller is willing to supply the product at the prevailing price.

6. Bidding processes exist for both buying and selling. However, the monopsony (one buyer) and monopoly (one seller) are essentially the same except for signs of some variables. Most of the bidding literature describes processes for selling only to avoid needless duplication.

7. See McAfee and McMillan (1987) for a detailed review of the bidding literature.

(2) Ascending-bid auction (Dutch)—the auctioneer calls out a relatively low price for the product available for purchase and gradually raises the price until a seller expresses a willingness to provide the product at the prevailing price. In practice, the auctioneer may be a meter that is set initially at a low price. When the meter is turned on, higher prices appear until a seller signals that the meter should stop.

(3) Discriminative auction (first-price sealed-bid in the case that a single unit is purchased)—each seller submits one or more sealed offers, and the required units are purchased from the seller offering the lowest prices.

(4) Uniform price sealed-bid auction (Vickrey auction; second-price sealed-bid in the case that a single item is purchased)[8]—the suppliers submitting the lowest offer prices win, but the price paid is equal to the lowest rejected offer.

Applications of some of these types of processes to QF bidding exist. For example, Massachusetts uses a discriminative auction, while the QF bidding process in California is a uniform price auction.[9] However, several investor-owned utilities in California are currently trying to change the form of the auction to a discriminative process.

Under a restrictive set of assumptions these four processes are equivalent in the sense that they: (a) yield the same price on average; (b) are efficient since the seller with the lowest cost wins; and (c) minimize the expected outlay for the buyer provided the buyer announces the appropriate reservation price (price above which he/she will not purchase).[10] The second-price sealed-bid auction has an advantage over the other three auctions in that it is "truth revealing." That is, the sellers will each bid their true estimate of the cost of supplying the product. To understand this last property, it is important to

8. Second-price sealed-bid processes are special cases (single unit as opposed to multiple units) of Vickrey processes.

9. In addition to the form of the bidding process, the California and Massachusetts systems differ in several other ways. First, there is a standard offer contract in California, so that a bid is in terms of price only. Massachusetts, on the other hand, allows bids on price and nonprice factors. Second, the California Public Utilities Commission (CPUC) has rejected levelized rates on the basis of unnecessary risk to the ratepayers, but the Massachusetts Department of Public Utilities (MDPU) allows levelized rates in certain situations. Third, CPUC has no policy on wheeling, whereas MDPU determined that wheeling to an external utility at a cost-based rate was necessary. Fourth, CPUC believes the ratepayers are already insulated from the risk of QF default so it does not require any additional guarantees. MDPU requires that QFs make a $15 per kilowatt deposit, which is paid to the utility if the QF project is not operational within 24 months of its proposed service date.

10. The assumptions for such an equivalence result to hold are: One risk-neutral buyer (the utility in the case of the QF market) wants to purchase a single unit of a product; sellers (the potential QF suppliers in the QF market) are risk-neutral; the independent private values assumption holds; sellers have identical characteristics (symmetry); and payment to the winner is a fixed price rather than contingent on ex post factors.

realize that the behavior of a seller is influenced by the bidding rules plus his valuation of the product. That is, the bidding rules determine the offer strategies. For example, the second-price sealed-bid process provides an incentive for a seller to offer a lower price than in a first-price sealed-bid process. The amount that the winning seller receives in a second-price sealed-bid process is not related to his offer. Therefore, the second-price sealed-bid process is "truth revealing" in that each seller submits an offer equal to his/her actual cost of the product. This truth-revealing property of the second-price sealed-bid process holds even if the risk-neutral assumption is not satisfied.[11] The CPUC gave considerable weight to this property in its decision to implement a uniform price rule for the QF market in California.[12]

The major concern for a buyer who has the ability to influence the choice of a bidding process is to select the process that yields the lowest price (optimal). Given the five basic assumptions, any of the four auctions is optimal provided the buyer will not accept offers above some appropriately chosen reservation price.[13] The optimal reservation price is the price that minimizes the buyer's expected cost given his own valuation of the product. The reservation price is analogous to the properly measured avoided cost. Optimality exists when the avoided cost accurately reflects the utility's expected cost.

I will argue below that the assumptions required for the equivalence result to hold are not satisfied in QF markets, and that some processes will emerge as better than others. From the perspective of the buyer (utility), the issue is designing a process that yields the lowest price for power from QFs.

The number of sellers required to achieve competitive results is an interesting issue. For double auctions, the experimental literature[14] contains examples of processes in which competitive results emerge with only three or four sellers. Therefore, large numbers of buyers and sellers may not be as crucial to attaining competitive results as one might be led to believe from the theoretical literature on market structure.

11. Cox, Roberson, Smith (1982) show that the optimal bid is equal to the cost of providing power independent of risk preferences and expectations about rivals' bids in a second-price sealed-bid process.

12. See "Before the Public Utilities Commission of the State of California" (1986), pp. 47-49.

13. The reservation price for a buyer is the maximum price he is willing to pay for the product. The reservation price for a seller is the minimum price the seller is willing to accept for the product. Interpreting avoided cost as a reservation price ignores problems of defining and measuring avoided cost.

14. Plott (1982). Experimental economics is the study of propositions implied by economic theories of markets in a controlled laboratory environment, which can be replicated by other researchers.

NATURAL GAS EXAMPLE

FERC has been considering bidding processes to allocate capacity on natural gas pipelines for some time, although it now appears to be considering alternatives.[15] Nevertheless, it is important to review the gas example, especially the types of processes FERC examined and the means it used to test the various approaches. Initially, FERC discussed three processes:[16].

(1) Walrasian Tatonnement process—the auctioneer calls out a price; gathers information on the quantity demanded and quantity supplied at that price; determines whether quantity demanded is greater than, less than, or equal to quantity supplied; and adjusts price either up or down in order to find an equilibrium. The important feature of this process is that contracts are not allowed to be finalized until the auctioneer determines the equilibrium price. This process is not very descriptive of actual trading situations since most markets lack an auctioneer and traders must process whatever information is available regarding the market environment. Furthermore, exchanges take place in "real world" markets at prices that do not represent an equilibrium.

(2) Double Auction—buyers and sellers call out (orally or electronically) bids/offers that can be accepted at any time. The FERC envisions a process similar to the New York Stock Exchange (NYSE). The commodity futures market described by Rozek and Wu (1987) is organized as a double auction. This differs from the Walrasian process since there is no auctioneer and binding contracts can be made at any price called out in the market. A trading price does not have to be an equilibrium price.

(3) Sealed-Bid process—buyers and sellers submit sealed-bids and offers. The auctioneer selects a single price from the range of prices that represents the equilibrium. With a finite number of buyers and sellers, the demand and supply curves are discrete. This means that the intersection of demand and supply is an interval of prices.

15. FERC Chairman Hesse "indicated that the Commission has shelved auctioning as a means of allocating capacity, finding after review that there may be other more workable ways to achieve the same benefits" ("FERC Chairman Hesse Tells NARUC Gas Committee," 1988, p. 3).

16. Bidding processes were viewed with a great deal of skepticism by the majority of organizations expressing opinions at the FERC's Technical Conference in August 1987. During the conference, interested parties made oral comments on the paper by Alger, O'Neill and Toman (1987) and 45 organizations subsequently submitted written comments. Thirty-seven of these organizations expressed opposition to bidding for a variety of reasons. Some organizations argued that bidding is illegal, given the existing framework for pipeline regulation. Others viewed the FERC's analysis as incomplete and thought that the bidding solution may be too radical given the nature of the problems (if any). Many other comments focused on operational problems with using a bidding process. The remaining organizations either favored bidding in some form or remained neutral. At the Technical Conference, FERC staff explained that the discussion paper was merely part of its research agenda on bidding issues. Its purpose was to stimulate discussion.

Recently, FERC presented the results of experiments with various bidding processes.[17] Alger (1988) reviews the developments in pipeline regulation that have led to FERC considering a more market-oriented approach. However, pipelines, distributors and end users appear strongly opposed to bidding. This opposition plus the results of the experiments (described below) may have caused FERC to back down from recommending a bidding scheme. FERC is now focusing on secondary markets in which rights to transportation capacity can be brokered (capacity brokering).[18]

Experimental economics allows economists to augment the study of naturally occurring markets with empirical analysis from controlled laboratory markets. Using experiments, economists are able to vary structural parameters of a market setting, including the number of traders and other organizational features. This makes it possible to examine the implications of different trading systems for buyers and sellers.

17. Alger (1988), Plott (1988) and McCabe, Rassenti and Smith (1988).

18. On April 4, 1988, FERC issued its "Notice of Proposed Rulemaking: Brokering of Interstate Natural Gas Pipeline Capacity." The proposed rule has stimulated a substantial number of comments from interested parties. Alger (1988) notes that capacity brokering would provide many benefits including: the allocation of transportation services to higher valued uses; increases in the spectrum of types of firm service currently offered; more immediate adjustments to new market conditions; and appropriate price signals to improve decisions on entry or exit. The United Gas Pipe Line Company proposed an experimental program on October 18, 1988 that would allow United to broker to others its firm transportation rights and firm contract storage rights in third party systems. The FERC approved the program on January 24, 1989. United's proposal will allow those who contract for the capacity rights in the third party facilities or those who possess capacity rights in the United system to resell their rights to others. The United proposal will provide FERC with data on which to base a decision concerning permanent capacity brokering. The highlights of the United proposal are outlined below:

- Firm service will be available on a first-come, first-serve basis, except United will give higher priority to any later requests for service at a higher price. The party submitting the earlier request at a lower price will have the right to pay a rate matching or exceeding the higher offer in order to retain priority. Once service has begun under a firm arrangement, it will not be subject to interruption.
- Interruptible service will be allocated on the basis of price. Upon five days notice, United can interrupt service to an interruptible shipper paying a discounted rate if another shipper agrees to pay a higher rate up to some predetermined maximum rate for the same interruptible service. The shipper facing interruption will have an opportunity to renegotiate its agreement with United at a higher rate and thereby retain its service.
- Both the firm and interruptible service will be subject to ceiling and floor prices.
- A shipper will have the right to resell both its rights in the United System as well as the firm rights for which it has contracted, provided it remains responsible for the costs and fees attributable to both the United system capacity and the firm rights that it resells.

For specific detals on the United proposal and the FERC's conditional approval, see "United Gas Pipe Line Company: Notice of Petition to Ammend" (1988), "United Proposes Three-Year Experimental Program for Brokering Its Firm Transportation Rights in Third Party Pipelines; Assistant to FERC Chairman Hesse Predicts Fast Action on United's Proposal" (1988), and "FERC Authorizes United's Experimental, Three-Year Capacity Brokering Program, With Modifications" (1989).

FERC commissioned two groups of researchers to carry out experiments as part of its work on gas pipelines. Plott (1988) reports on three sets of experiments, only one of which was successful. The unsuccessful experiments involve the Automated User Selection Mechanism (AUSM) that he developed for NASA and Administered Trial and Error Pricing (Tatonnement Process). In these experiments, there were too many frivolous bids, literally no trades were ever made. The experiment that shows promise involves an unrestricted, decentralized market organized with a double auction process. This yielded a competitive solution and high degree of efficiency with as few as two competitors on each pipeline.

McCabe, Rassenti and Smith (1988) conducted "smart" experiments.[19] Buyers and sellers submitted demand and supply schedules; and a computer solved a linear programming problem to determine prices. This group considered both duopoly and monopoly pipeline markets, and achieved higher degrees of efficiency than Plott. Of course, efficiency is lower in the monopoly case.

BIDDING FOR POWER

QF Markets and Bidding Theory

In QF markets, the five basic assumptions identified previously[20] as necessary to obtain the equivalence of the four common auctions are not satisfied. There may exist multiple players (utilities and QFs) on both sides of the market, especially if interutility wheeling exists and the underlying product is divisible so that a buyer may select several winning sellers. Sellers may offer different amounts and types of capacity as well as use a variety of power production technologies (heterogeneity). The utilities as well as the QFs are most likely risk-averse as opposed to risk-neutral firms; in fact, risk aversion is a common characteristic of economic agents.[21] It also seems reasonable that the economic cost of generation capacity consists of two parts: a value common to all players and one that is QF specific. In other words, the most likely situation is one in which there are elements of the independent and common-value assumptions. In the context of QF markets, differences in offers to sell power to a utility may reflect differences in (a) estimates of the cost for a given technology (differences may be eliminated by pooling

19. The group used a similar scheme in experiments on power transmission conducted for the Arizona Corporation Commission.

20. See the discussion below.

21. A risk-neutral individual is one who would pay $0.50 to play the game: flip a coin, win $1.00 if heads appears and $0.00 if tails appears; whereas, a risk-averse individual would find $0.50 too high. Intuitively, risk aversion means a preference for reasonable and secure policies.

information); and (b) the costs of alternative technologies. There may be requirements (possibly imposed by regulators) that preference be given to QFs either located within a region or using a particular type of fuel; thus, the symmetry assumption may not hold. Finally, the offers may include a payment based on future performance (contingent payment).

Unfortunately, a consistent set of assumptions for QF markets cannot as yet be determined. Some assumptions will depend on decisions by state and federal regulators as well as the utilities and QFs. Therefore, based on existing theoretical work, it is impossible to draw general conclusions about the optimal and efficient bidding process for purchasing power from QFs. Even if we could agree on the assumptions that apply to a given market, the theoretical framework for determining the efficient and optimal bidding process has not been developed. Further, if such a bidding process could be designed, the opportunity to select that process may not be available to utilities. The regulators may make the decision taking into account input from QFs, ratepayers, politicians, and other interested parties, as well as utilities.

The importance of describing the QF market in light of the basic assumptions is illustrated in the following example. When many potential bidders (QFs) have technologies with similar costs, the question of whether a utility should make its reservation price (avoided cost) public becomes more important than when QFs have distinct technologies. With the common value assumption, the utility will decrease its expected outlay by publicizing its avoided cost provided it is an accurate representation of the true value of the cost of power. The accurate information, together with the knowledge that other QFs have similar technologies, will encourage those potential QFs who perceived the avoided cost for the utility to be relatively low to participate in the bidding, and thus increase competition. With the independent, private-value assumption, the information about the utility's avoided cost is less important to a QF determining an offer strategy since it does not have information about the technologies of the other bidders. Since the independent-value assumption most likely applies to QF markets, there are relatively few, if any, benefits to a rule that requires the utility to reveal its avoided cost.

The desirable properties of a bidding process from a utility's perspective may not be considered appropriate from the perspective of the other groups interested in QF markets. Nevertheless, the first step is to determine a set of assumptions consistent with the decision environments in which electric utilities and QFs operate. One can, then, examine these assumptions from a theoretical perspective to design a set of processes that will promote an efficient and/or optimal allocation of resources. If the theoretical problem is not tractable or requires empirical support, techniques from experimental economics may be useful for gaining insight into the properties of various auction processes.

FERC has already addressed the open (oral or electronic) submission of bids versus sealed-bid institution in the context of electricity transmission capacity. In a recent decision involving an auction for Baltimore Gas and Electric Company's (BGE's) unutilized share of the transmission capacity of the Pennsylvania-New Jersey-Maryland Interconnection (PJM) 500 kV EHV transmission system for importing energy from electric utility systems located west of PJM, FERC approved an open-bid proposal after first rejecting a sealed-bid proposal.[22] In this decision, FERC (a) expressed a preference for open- or oral-bid auction over sealed-bid auction even for a complex product, (b) highlighted the desirable efficiency consequences of BGE's plan, and (c) considered BGE's lack of market power.

It is useful to analyze BGE's proposal in the light of the information on bidding theory presented earlier. First, the players' confidence in the bidding process certainly existed in the BGE case. The seller (BGE) and bidders were known to each other. The incentive to renege on a commitment was reduced since the players interacted in PJM on a continuing basis. Second, the open-bid format assured that any information available from the individual bids would be available to all the participants in the bidding process, not just BGE.

FERC has also issued a "Notice of Proposed Rulemaking" (NOPR)[23] on whether competitive bidding is a viable means of determining avoided cost. This calls for states to have the option of using bidding to price power from QFs under PURPA. The NOPR is not without its problems, in fact, there are five major problems with its present version.[24] First, it is excessively complex since it requires all-source bidding system approach.[25] This complicates the problem and may actually discourage states from experimenting with QF-only bidding. States may prefer to start with a QF-only bidding scheme and expand to other sources once they get more experience. Second, FERC seems to envision a very structured bidding process. The NOPR does not allow for utilities to develop flexible negotiation systems or experiment with combined

22. "Order Accepting Rates for Filing Without Suspension and Granting Waivers: Baltimore Gas and Electric Company" (1987). Of course, FERC's preference is specific to the BGE's proposal. It may not represent a general policy.

23. "Notice of Proposed Rulemaking" (1988). In the NOPR, FERC set out proposed conditions on the use of bidding. A considerable amount of discussion regarding the NOPR has already taken place. Some 250 organizations commented to FERC on the NOPR.

24. The remainder of this section is based on input from Professor Paul Joskow of M.I.T. and other NERA staff.

25. The NOPR clearly promotes bidding schemes that include independent power producers, utility construction, wholesale power transactions between utilities as well as QFs.

bidding, negotiation and construction schemes. Third, the discussion in the NOPR may be viewed as an attempt by FERC to preempt state jurisdiction, in some areas, especially utility construction and subsequent ratemaking treatment of facilities. Fourth, the NOPR proposes a standard for workable competition[26] that is unnecessary for QF-only bidding (under PURPA) and does not have support in economic theory. Finally, the NOPR seeks comments on transmission access. Clearly, it is not necessary to require transmission access as a condition for bidding under PURPA. However, whether transmission access issues can be ignored in the context of FERC's all-source bidding perspective needs to be addressed in more detail.

Review of Existing Bidding Plans

Electric utilities are already experimenting with competitive bidding processes to purchase system supply. NERA recently completed a review of bidding processes[27] by analyzing Requests for Proposals (RFPs) from nine utilities that have either been issued or received approval from a state regulatory commission.[28] Analysis of these bidding processes provides some insight into the design issue.

The objectives of the review were to (a) examine each utility's experience with bidding; (b) identify the basis for bid evaluation procedures; and (c) catalogue the specific evaluation factors included in each RFP. This was accomplished by studying the utility RFPs in depth and contacting utility representatives with follow-up questions. The results of the review are briefly summarized below.

Seven utilities had sufficient experience to offer conclusions about the success of their process. Of these, six were satisfied with the results. One questioned whether the procurement process was expedited by bidding since it had experienced prolonged, ex post contract negotiations. The RFPs reviewed included both QF-only and all-source solicitations. Utilities received offers for five to 10 times more capacity than requested. There was general satisfaction with the technical details of the proposed projects, although one utility received a proposal to construct a superconducting ring, which it rejected. All utilities believe they either have the authority to reject clearly

26. A bidding process is workably competitive if offers from at least three sources independent of the purchasing utility are received and the potential capacity equals or exceeds the amount needed by the utility.

27. Michael Rosenzweig was primarily responsible for conducting the survey.

28. The utilites are Boston Edison Company, Central Maine Power Company, Commonwealth Electric Company, Eastern Edison Electric Company, Green Mountain Power Corporation, New England Power Company, Sierra Pacific Power Company, Virginia Electric Power Company, and Western Massachusetts Electric Company.

unrealistic proposals or could take that type of problem to their commission to resolve.

Four of the RFPs chosen for review were developed by Massachusetts utilities under rules set by the state commission.[29] These rules require a mechanistic, quantitative ranking plan that allows self-scoring by proposers. In the remaining cases, ranking plans were significantly less explicit about relative weights among factors and, in some cases, in identifying the evaluation factors. Two RFPs had no ranking scheme for price and nonprice factors. One utility, as a matter of corporate policy, would not discuss the details of its evaluation procedure because it believed that dissemination of these could produce higher bid prices, and harm ratepayers. In every case where explicit, quantitative ranking plans existed, the basis for setting the various weights rested primarily on the judgements of utility personnel concerning the value of various factors.

There was substantial variation among utilities in the selection of evaluation criteria and relative weights. This is not surprising since each utility has a unique set of power needs. Table 1 summarizes the ranking criteria used by each utility. Certain areas of emphasis are common. Price, along with other economic factors such as security for project completion and front-loading, is always a central factor. The main thrust of the noneconomic factors is to measure the stage of a project's current development; the proposer's knowledge of power plant project construction and operation; and the feasibility of the proposed projects.

POLICY ANALYSIS

Bidding processes are likely to be the subject of major policy initiatives in the electric utility industry during the next several years. Federal and state regulatory agencies are considering market approaches (as opposed to regulation) as a means to achieve an efficient allocation of resources in both generation and transmission. FERC has limited experience in comparing alternative market approaches in the electric industry. In complex transactions such as electric utilities buying power from QFs, the theoretical basis is not sufficiently developed to allow economists, regulators, or utilities to determine an efficient, optimal bidding process. Nevertheless, it may be possible to proceed if it is perceived that bidding improves upon the existing system.

29. New England Power Company administers a bidding program for its Massachusetts retail affiliate pursuant to an experimental exemption from the rules of the MDPU.

Major problems arise in three areas. First, economic theorists have not been able, as yet, to derive comparative results among bidding processes under assumptions that approximate trading situations in QF markets. Some of the characteristics of QF markets are related to their specific location. Nevertheless, it may be possible for federal agencies to give guidance to statesand other parties on bidding schemes. At this stage, states and utilities need considerable flexibility in designing bidding schemes.

According to a survey of bidding processes in QF markets[30], 20 states either have implemented, endorsed, or are currently considering bidding systems. Recent developments include the New York Public Service Commission (PSC) opinion and order on bidding, avoided-cost pricing and wheeling.[31] The conclusions of the PSC were that "utilities should be authorized, indeed encouraged, to undertake bidding for new electricity capacity immediately, and that the bidding procedures should be left to the utilities to determine; that retail wheeling should not be adopted for the present; that further proceedings be convened to examine wholesale wheeling issues; and that the recovery of utilities' costs of electricity production should not be limited to 'real time' costs."[32] Three utilities were ordered to file bidding guidelines with the PSC by October 17, 1988; four other utilities were given until December 1, 1988.[33]

The Opinion and Order adopted most of the recommendations proposed by Administrative Law Judge Frank Robinson.[34] The PSC took the position that "bidding provides a useful way to choose among third-party producers."[35] Bidding also provides "a valuable yardstick against which to judge such other power supply proposals as may in the future come forth from the utilities or from other entities."[36]

30. Hamarin, Wellford, Robertson and Smutny-Jones (1987).

31. "Opinion and Order Concerning Bidding, Avoided-Cost Pricing, and Wheeling Issues" (1988). Two of the seven commissioners issued dissenting statements. Commissioner Jerry expressed concern that bidding would encourage a large number of gas and coal fired projects that are subject to relatively few environmental controls. Commissioner McFarland prefers the existing regulatory structure to bidding since he believes the former approach is better at providing New York ratepayers with the right amount of electricity at the right price. A number of other states have either recently endorsed bidding or are very close to endorsing bidding.

32. Opinion and Order (1988), p. 2.

33. The first group consists of Long Island Lighting Company, Niagara Mohawk Power Corporation and Orange and Rockland Utilities, Inc. The second group includes Central Hudson Gas and Electric Corporation, Consolidated Edison Company of New York, Inc., New York State Electric and Gas Corporation and Rochester Gas and Electric Corporation.

34. Robinson (1987).

35. Opinion and Order (1988), p.8.

36. Opinion and Order (1988), p.8.

Table 1. Ranking Criteria Included in Requests for Proposals

	Boston Edison (1)	Central Maine (2)	COMM Electric (3)	Eastern Edison (4)	Green Mountain (5)	New England (6)	Sierra Pacific (7)	Virginia Electric (8)	Western Mass. (9)
ECONOMIC FACTORS									
1. Price	40.0%	X	X	40.0%	X	X	X	X	X
2. Dispatchability/ Interruptibility	4.0%/3.2%	X	X	10.0%	X	X	X	X	X
3. Security Provisions							X	X	X
a. Break Even	12.0%		X	6.0%					
b. Secured Front Loading	8.0%	X	X	10.0%	X	X		X	X
c. Price Confidence				4.0%					
d. Other			X (4)						
4. Interconnection Costs					X			X	
5. Term of Contract			X				X		
6. Market-Out Provision (1)						X			
Total for Price Factors	64.0%			70.0%				70.0%	
PROJECT VIABILITY FACTORS									
7. Project Schedule and Milestones					X				
In-Service Date Certainty	X							X	
8. Project Permitting Plan and Schedule	2.4%		X	1.6%	X	X	X		X
FERC Certification (2)									

Table 1. Ranking Criteria Included in Requests for Proposals (Continued)

	Boston Edison (1)	Central Maine (2)	COMM Electric (3)	Eastern Edison (4)	Green Mountain (5)	New England (6)	Sierra Pacific (7)	Virginia Electric (8)	Western Mass. (9)
9. Project Financing Plan and Schedule	2.4%		X	4.0%	X	X		X	X
10. Debt and Operating Coverages	2.4%								
11. Additional Security Deposit	2.4%	X							
12. Additional Development Security	1.6%		X	0.8%					X
13. Project Management (3)			X	2.4%					X
14. Project Development Team and Experience									
a. Prior Operating				1.6%	X	X	X	X	
b. Experience	2.4%				X	X	X		X
15. Project Size	0.8%		X	0.8%			X		X
16. Project Technology	4.0%					X		X	
17. Thermal Contract	0.8%			2.4%		X		X	X
18. Engineering Design/ Development	1.6%		X	3.2%	X	X		X	X
19. Construction/Operation Stage	0.8%						X	X	
20. Interconnection/Wheeling Considerations				0.4%	X		X		
21. Site Control/Ownership	4.0%		X	1.2%	X	X			X
22. Stability/Security of Fuel Supply	2.4%		X		X	X	X	X	X

Table 1. Ranking Criteria Included in Requests for Proposals (Continued)

	Boston Edison (1)	*Central Maine (2)*	*COMM Electric (3)*	*Eastern Edison (4)*	*Green Mountain (5)*	*New England (6)*	*Sierra Pacific (7)*	*Virginia Electric (8)*	*Western Mass. (9)*
23. Form of Liquidated Damages Fund		X							
24. Maintenance: O&M Contract or Escrow	0.8%				X				
Total For Project Viability Factors	28.8%			18.4%					
OTHER FACTORS									
25. Fuel Type	4.0%		X	4.0%		X		X	X
26. Location	1.6%		X	0.8%	X		X	X	X
27. Environmental Benefits/ Considerations			X			X			
28. Fuel (Thermal) Efficiency				5.0%					X
29. Voltage Control				0.6%					X
30. Maintenance Schedule Coordination	1.6%	X	X	1.2%	X	X	X		X
31. Exceptions to Model Agreement								X	
32. Ownership Diversification								X	
33. Compatability with Power Pool Arrangements		X							
Total For Other Factors	7.2%			11.6%					

X — No explicit weight provided

Table 1. Ranking Criteria Included in Requests for Proposals (Continued)

	Boston Edison (1)	*Central Maine (2)*	*COMM Electric (3)*	*Eastern Edison (4)*	*Green Mountain (5)*	*New England (6)*	*Sierra Pacific (7)*	*Virginia Electric (8)*	*Western Mass. (9)*

(1) A Market-Out provision allows the purchaser utility to nominate a new price if the contract price is higher than the price for equivalent electricity in the wholesale power market, with a right of the supplier to sell the power elsewhere if such new price is unacceptable.
(2) FERC certification is explicitly included in "Project Permitting Plan and Schedule" for Eastern Edison and WMECO.
(3) There is some overlap between Project Management and Experience. In general, Experience only considers prior experience, whereas Project Management considers both prior experience and whether seller/engineer/constructor/operator are committed by contract to participate in project.
(4) Bidders that agree to an "Easement and Covenant Running with the Land" and "Agreements of Subordination and Attornment" receive extra points.

Sources: Col. (1) Boston Edison Company Request for Proposals #2.
Col. (2) Central Maine Power Company Cogeneration/Small Power Production Request for Proposals, December 4, 1987.
Col. (3) Commonwealth Electric Company Request for Proposals, First Solicitation.
Col. (4) Eastern Edison Company, Request for Proposals, October 8, 1987.
Col. (5) Green Mountain Power Corporation,Request for Proposals: Energy and Capacity, May 31, 1988.
Col. (6) New England Power Company, Request for Power Supply Proposals, 1988 Solicitation.
Col. (7) Sierra Pacific Power Company, Request for Power Purchases, April 15, 1988.
Col. (8) Virginia Electric Power Company, Request for Proposals for Power Purchases, 1988 Solicitation.
Col. (9) Western Massachusetts Electric Company, Request for Proposals, First Solicitation.

The major difference between the PSC's Opinion and Order and Judge Robinson's recommended decisions concerns demand-side management (DSM).[37] The PSC directed utilities to develop bidding processes that include DSM projects. Judge Robinson, however, recommended DSM not be included in a bidding process. The PSC believes such DSM projects have favorable (though unspecified) nonprice characteristics that outweigh potential problems.

While the PSC does not endorse a particular bidding process, it adopted the following eight guidelines for bidding:

(1) Utilities must provide all information having a bearing on project viability to potential non-utility bidders.

(2) Utility subsidiaries may participate as bidders subject to conditions recommended by Judge Robinson.[38] In addition, the utility must agree to provide "wheeling out" services for other bidders.

(3) All sources (QFs and non-QFs) should be allowed to participate in the bidding process.

(4) Subjective judgement through such activities as post-bid negotiation is permissible.

(5) The utility should make explicit the weights used to evaluate price and nonprice factors.

(6) Utility construction of new generating capacity should be the last resort.

(7) The utility may require bidders to pay an entry fee to include only serious bidders.

(8) The utility may include contractual provisions that compensate it for performance failure.

In general, the Opinion and Order strongly endorses bidding. However, some of the PSC's recommended guidelines such as the wide open information provisions, may be extremely costly for utilities. Second, the status of the $.06/kWh minimum purchase price established by the New York Service Law §66-c is unclear. The PSC does not view the recent FERC decision on this issue[39] and subsequent discussion as affecting its conclusions.

Based on the available evidence, one can already observe several trends regarding bidding systems in QF markets. First, it is clear that federal and state

37. Integrating demand-side and supply-side options into a single bidding system may not be sound public policy. See Joskow (1988).

38. The conditions are: the utility must use a sealed bid auction with the bids opened by an independent party, the utility must provide full justification for rejecting bids other than the subsidiary's bid, and unfair or abusive practices should result in reduction in the allowed rate of return or other sanctions.

39. "Order on Petition for Declaratory Order (Orange and Rockland Utilites, Inc. et al),"(1988).

regulators will be actively involved in designing and implementing bidding processes. Regulatory goals such as achieving benefits for ratepayers, encouraging QF development, and complying with PURPA and relevant state statutes will be factored into any policy debate. Utilities will not be able to select unilaterally the process that will govern their transactions with QFs. As in New York, regulators may allow utilities considerable flexibility but remain ready to correct any abuses or resolve disputes. Furthermore, the allocation of the gains from bidding among utilities, QFs, and ratepayers may not be resolved in a consistent manner between federal and state agencies and across states.

Second, the long-term complex nature of the underlying product means the bidding process must encompass both price and nonprice factors.[40] Regulators may participate in designing or approving an explicit ranking scheme or allow flexibility for utilities choosing bidding to select the winning bids subject to review by regulators. New Jersey is an example of a state with an explicit ranking system while Virginia has a flexible approach. The complex nature of power transactions means that the resulting process will involve bidding and subsequent negotiation. Establishing explicit ranking systems to cover a large number of diverse projects may be costly. Regulators may want to allow utilities flexibility subject to ex post scrutiny.

The information already available supports the conclusion that bidding processes (with negotiation) are feasible solutions to allocating energy resources. It includes: (a) theoretical work on bidding processes; (b) analyses of processes by means of controlled laboratory experiments; (c) real field experiments concerning posted-price institutions with subsequent negotiation, such as the Southwest Bulk Power Experiment; (d) the Western Systems Power Pool Experiment; and (e) knowledge gained from other "real world" auction markets. Bidding processes exist for markets in which the underlying products are complex such as oil, gas, and coal leases. Furthermore, bidding processes can improve upon regulatory solutions. We will need to draw on all of this information in seeking to guide public policy.

Although economic theory does not yet provide much insight into the design of bidding processes for QF capacity, we can offer some additional comments on the form of the optimal auction for QF capacity. It should already be clear that the rules do indeed matter. The most likely processes will involve a single buyer seeking offers for QF capacity from several sellers. In spite of FERC's endorsement of an open bid in the decision regarding BGE, the complexity of the underlying product and the lack of an established relationship among utilities and QFs suggest a sealed-bid approach that can

40. California is the exception with standard offer contracts.

incorporate price and nonprice factors. The standard offers used in California may prove to be unworkable as suggested by recent efforts on the part of investor-owned utilities in California to change the system. The truth-revealing property of second-price auctions certainly appeals to regulators as a means to satisfy their desire for accurate cost information. However, recent work suggests an increase in the likelihood of collusion when a second-price process is used.[41]

A utility wants to guarantee that a supply of power will be available to meet its needs. QFs, on the other hand, are chiefly concerned with getting a commitment from a utility that can be used to obtain financing. One way to reconcile these divergent interests when designing QF bidding schemes is to consider contingent payments. That is, an offer will consist of a price for each unit of power plus a penalty the QF is willing to pay if the power is not available on schedule. Nonprice factors could also be included. Contingent payment schemes are quite common in a wide variety of processes from corporate control to defense procurement. Economic theorists are already obtaining results regarding auctions that combine second-price rules and contingent payments.[42] Such models may be useful in designing auctions for QF capacity.

In sum, power supply projects are very complex and not necessarily amenable to structured bidding processes. It is often difficult to rank design and operational features of projects in order to implement a highly structured bid solicitation and selection system. Flexibility should be a key factor as FERC and state regulators move toward more market-based approaches.

41. See von Urgern-Sternberg (1988). The incentive with a second-price auction is for bidders to bid the true cost of supplying the commodity. However, if there is an agreement among the bidders (i.e., cartel) on which participant is to win, there is a strategy that will leave no incentive for any other cartel member to try to cheat on the agreement. Namely, the designated winner should simply bid an extraordinarily low "fantasy" bid.

The "fantasy" bid would be set lower than any other participant's cost for providing power, and a chiseler could only win by bidding lower than the "fantasy" bid. Under the second-price auction, the chisler would then have to pay the designated winner's bid which, by design, is less than the chisler's cost of providing the commodity. Thus, the chisler loses. If nobody cheats, then the designated winner supplies power at the second lowest bid.

If all participants are part of the cartel, and the utility announces an avoided cost, bidders have no economic incentive to bid less than the avoided cost. Thus, the designated winner profits by the difference between his true cost and the avoided cost. If not all bidders are in the cartel, there is some risk that someone will have (and thus bid) a lower cost than the designated winner's cost. In that case, the winner will suffer a loss. This risk will cause the "fantasy" bid to be raised reducing the incentive to collude by cartel members. Further, if the cartel designates as the winner a member who does not have the lowest cost of supplying power, the result will be inefficient.

Finally, it is interesting to note that results from experiments using both first-price and second-price sealed bid processes with experienced bidders suggest a tendency toward tacit cooperative behavior. See Cox, Smith and Walker (1985).

42. Laffont and Tirole (1987).

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