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The issue of long-term contracts is critical to the U.S. markets, because private suppliers must have price stability to acquire debt financing for their projects. A typical cogeneration project will have anywhere from 50 to 75 percent of its capital provided by private lenders. The terms of such loans are commonly for ten years. The lender needs to have certainty about the project's revenue stream. Long-term fixed price power sales contracts provide such certainty. In the case of gas-fired cogeneration, a pricing formula indexed to natural gas prices is actually a reasonable substitute for complete price certainty.

By itself, a long-term fixed price power purchase contract need not induce an oversupply problem. The emergence of oversupply in California and Texas was caused by the simultaneous occurrence of numerous other factors. First and foremost was the failure of regulators to limit the availability of the posted long-term prices to a specific quantity of power. The offers made were open-ended, presumably under the expectation that supply would not exceed the need for power.

In addition to the open-ended nature of the long-term contracts offered in California and Texas, changing expectations on the part of suppliers also contributed to oversupply. The California offer was made in the summer of 1983, and the Texas offer about one year later. Toward the end of 1984, it became apparent that world energy markets would experience a period of static demand and weakening prices. Potential PURPA producers began to perceive that future revisions to long-term pricing offers would involve downward adjustments to contract prices. Therefore, they all attempted to ''lock in'' favorable terms by signing up for the posted price currently available. This response was called a ''gold rush'' in California.

Oversupply problems are not nearly so likely to occur in developing countries, where power supply shortages are a chronic problem. The California and Texas problems emerged in part because growth in demand had slowed considerably compared to earlier periods, which themselves were even lower than demand growth in developing countries. Apart from oversupply, there is still an issue involving the need to price power at its value to society and to avoid paying more than it is worth. Since the value of electricity is linked to prices in world energy markets, there will be a need to reflect changes as they occur.

5. PURPA REFORM

The large response of private suppliers to PURPA implementation has created interest in a re-examination of the process. Two issues have emerged in the recent discussion which promise to alter PURPA procedures substantially. These are the introduction of independent power producers (IPPs), and the proliferation of auction and bidding systems. The arena in which these issues have arisen is an investigation of PURPA by FERC. FERC has responsibility under PURPA to issue rules that direct state utility regulators in their implementation of requirements. FERC held hearings in 1987 to receive comments on the experiences of states and, as a result, issued proposed rulemakings that address the IPP and the auction issues (Federal Energy Regulatory Commission, 1988a, 1988b, 1988c).

The auction question has arisen because of an excess of offers to sell power when long-term contracts are made available, as we have noted earlier. The original PURPA implementation rules did not contemplate such a situation. Experience has shown that long-term contract offers bring forth large responses from cogenerators while there is little or no interest in short-term revisable traffic. A recent study by the staff of the New Jersey Board of Public Utilities is typical. Response to five years of tariff availability by suppliers was minimal; once long-term contracts were offered, the response was greater than some estimates of need. Under the tariff approach only 15MW of capacity was installed by 1986. Forecasts for 1990 are for 940MW. All the incremental gains are due to the offer of contracts (New Jersey Board of Public Utilities, 1987).

The PURPA approach has been a first-come, first-served system. As long as offers were of a relatively small magnitude, there is no great harm in this. With substantial supply, however, this system becomes inefficient. The PURPA avoided cost system not only gives no way to ration long-term contracts, it also does not allow any of the economic benefit of competition to be passed along to customers. The auction framework addresses both of these concerns. First, a bid acceptance procedure is an automatic mechanism for selecting the lowest cost offers. Second, the rationing effect of an auction also will lower the cost of power compared to the administratively-determined avoided cost approach. Competition bids down the cost of purchase by selecting those producers who offer the biggest discount from avoided cost. In the case of potentially excess supply, the bids must be below avoided cost, or the utility should reject them all and supply the power itself.

FERC is expected to allow auctions as a method of implementing PURPA. Some states have already done this; in the future more can be expected to use this mechanism. It is not likely that FERC will either require auctions or specify how they should be conducted in detail. This will leave considerable implementation details to the states. Many of these details have not been worked out, and they will present analytical challenges to utilities and regulators. Two of the most important issues involve bid evaluation methods and the treatment of dispatchability. The issues are outlined briefly below.

Bids are difficult to evaluate if they differ substantially in form. Two dimensions of difference are particularly important. These are the length of the purchase contract and the time-path of proposed prices. Capital-intensive technologies (coal, hydro, geothermal) typically need higher initial prices and longer-term contracts than less capital-intensive technologies. In the long run, there may be lower total costs from capital intensity. A bid evaluation system must be able to make these trade-offs in the specific context of a particular power system.

Dispatchability is a general term for the responsiveness of generation output to fluctuations in demand. There is a great range of such responsiveness. Developing economic valuation methods for different degrees of dispatchability is a difficult task. Its importance will grow, however, as more and more power is purchased from private producers. While state-of-the-art methods are being developed to value the dynamic benefits of dispatchability, there is no general consensus on how this should be done.

The second FERC initiative related to PURPA reform is the creation of a new type of private power producer, the IPP. IPPs are entities that do not meet the PURPA definition of a qualifying facility. Therefore, they cannot compete directly in PURPA auctions. The FERC initiative regarding IPPs is to nonetheless allow state commissions to consider bids from them in PURPA auctions. One way to construe their participation lies in the definition of avoided cost. To date, utilities have made administrative determinations of avoided cost. There has been no real market or competitive estimate outside of the recent interest in auctions. Under the FERC proposal, a utility will first solicit bids from IPPs. The best such bid becomes the avoided cost. PURPA auctions then would be held to see if better offers emerge. If so, then they should be accepted. If not, then the best IPP bids should be taken.

There are two advantages to this proposal. First, by enlarging the range of competition it is likely that lower costs will result. The PURPA restrictions remove a number of technologies from competition that may have lower costs than qualifying facilities. Second, the introduction of IPPs can reduce the need to rely on administrative estimates of avoided cost. There may be cases where it is still necessary to make these estimates, i.e., no IPP bids are offered. But where the estimation can be eliminated, it would be desirable since these estimates are difficult to make.

The IPP initiative would also include an exemption from rate-of-return regulation. Having been selected in a competitive process would be sufficient to determine that prices paid to IPPs met the "just and reasonable" standard. This exemption is also granted under PURPA. IPPs would not, however, be granted the right to sell power to utilities unless they are selected in a competition. This is another distinction between IPPs and qualifying facilities under PURPA. The latter retain the right to sell under short-term tariffs.

One of the central ambiguities of the IPP proposal is the status of regulated utilities. Can they bid as IPPs to meet their own customers' load? There is no policy consensus on this issue. The argument in favor is simply that additional competition is good, and that utilities may bring special advantages that could lower costs. The argument against is that the potential for anti-competitive self-dealing is too great in this situation. How can a fair evaluation be made if the utility is both making offers and evaluating bids? It is not clear how this issue will be resolved. Its implications for the future structure of the regulated industry are substantial.

There are other issues raised by PURPA reform as well. These are less proximate and less clear than the auction and IPPs proposals. One involves the role of demand-side interventions. Estimates of demand play a role in the determination of the need for power. Beyond that, however, demand-side programs are often economic ways of meeting additional need. It has been suggested that competitive procedures play a role here. The major question is whether it is feasible to have a competition between supply-side and demand-side resources. There is great difference of opinion here and very little experience. Over time, this question is likely to persist.

Another PURPA-related issue is the role of transmission. As more private producers enter the system, demands on transmission increase. How will these be met? Who will control access, pricing, and capacity planning? Under what principles will these decisions be made? These

questions are very fundamental ones concerning the structure of the electric utility industry. PURPA has made major changes in the way this industry works. The dynamic which has been initiated will continue to operate, gradually re-shaping the rules of the game. The end result will be very different from the historical tradition of vertical integration in the electricity utility industry (Kahn, 1988).

6. ISSUES RELEVANT TO DEVELOPING COUNTRIES

Broadly speaking, utility networks in developing countries can be expected to experience greater difficulties integrating private power into their systems than the U.S. The source of these difficulties lies primarily in the less developed nature of the technical and economic infrastructure. Anecdotal accounts of such problems in the Indian power system suggest that this is a significant issue (''Groping in the Dark'', India Today, July 15, 1984). We will briefly outline some of these potential problems.

Technical Infrastructure

Private power production requires the interconnection and coordination of decentralized generation into the utility network. There may be weaknesses, deficiencies, or inefficiencies in the current operation of these networks that will be exacerbated by the introduction of private power production. At a minimum, the need for more engineering talent may impose manpower costs or constraints that are not binding or unusual in the U.S., but may be in developing countries. Capital investment in transmission and distribution capacity will almost certainly increase under PURPA-type arrangements. It is not clear whose responsibility such investment will be.

Economic Infrastructure

Cogeneration projects depend upon a reliable fuel supply for continuous operation. In many developing countries, it is not possible to assure a continuous and reliable supply of fuel. The source of such difficulties can lie in labor problems, transport problems, or international politics.

The development of private power markets depends in large degree on a complex structure of legal contracts among suppliers of fuel, equipment, and financing. We have already discussed the role of contracts for the purchase of power. In addition, insurance markets also make possible the reduction of risk and liability to levels tolerable for private investment. Developing countries may not have a full set of markets that can produce the set of arrangements necessary for the creation of a private power industry.

7. CONCLUSIONS

The main purpose of this review of PURPA at this conference has been to urge key individuals in Thailand to give serious consideration to policies that promote private power generation. It is our view that the promotion of private power may make good sense in a country such as Thailand. Thailand possesses substantial engineering capability, but raising sufficient capital for the power sector presents considerable difficulty. The demand for electricity continues its rapid growth. A full range of strategies—including aggressive promotion of conservation and new

approaches to electricity supply—is needed to deal with the rapid demand growth.

We believe that PURPA can, in some ways, serve as a model for Thailand. PURPA has been enormously successful—too successful, some would argue—in promoting new electricity supply. But major problems are also evident under the original PURPA design: no effective means of control of the quantity of power offered and contracts that failed to minimize the costs of power. These problems are currently being addressed by FERC in the U.S.

We are optimistic that the new procedures for PURPA will result in more successful balancing of supply, demand, and price issues. We recommend that Thailand carefully follow these types of development in the U.S.

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