Viewpoint

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Competitive Contracting for Privately Generated Power

What to do in the absence of competition in the market

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The importance of competition

Independent power producers (IPPs) are an increasingly important type of power generation project in developing countries. In many of these countries, power sector reform involves unbundling generation from transmission and introducing private capital. Rather than privatizing existing generators, some governments prefer to create an enabling environment for IPPs. They have two objectives in doing so. First, by using truly competitive bidding to procure new generation capacity, governments seek to minimize the costs of expanding power supply. And second, by introducing the profit motive and competition in the power and energy sector, they seek gains in operational efficiency that lead to lower prices for electricity users than would otherwise have been possible without subsidies.

The second result is especially hard to achieve, and when achieved, it can be even harder to sustain. Governments in most developing countries lack the proven track record of transparent regulation of their power sectors that is needed to attract private investment. Thus, long-term contracts (power purchase agreements) are required both to encourage entry by potential investors and to safeguard their interests. Such contracts attempt to share the risks between the parties in a predictable fashion. But because it is difficult to write legal clauses that cover uncertainties about future marketing conditions, they cannot be fully contingent, so inefficiencies arise in system operation. For example, at the time of signing a power purchase agreement, the IPP may be the most efficient plant in the merit order and should indeed run on base load as specified in the typical contract. But circumstances can change, and after a few years, running the IPP as baseload might no longer be optimal. When a contract does not allow for such a contingency, the operational efficiency of the system tends to decline. And contracts that provide for guaranteed sales to reduce private investors' risk reduce the competitive pressure on them to operate their plants efficiently.

There is inevitably a tension between designing contracts to reduce uncertainty for the private investor and running the power system as efficiently as possible. The characteristics of power sales agreements are pivotal in resolving this tension. This Note surveys a range of selling agreements—from the most rigid to the most flexible—and highlights their risks and benefits for operational efficiency.

Some of the most common contractual arrangements for IPPs place no competitive pressure on existing suppliers. These arrangements will not help improve the efficiency of the sector. They will only increase supply capacity—though that can be valuable in a system facing public financing constraints. When the entry of IPPs fails to put competitive pressure on other suppliers, governments need to design other efficiency-enhancing reforms, such as performance contracts for the nonprivate generators. And if the contract does not lead to head-to-head competition between new IPPs and the other suppliers, it should include performance incentives to ensure that the IPP remains an efficient supplier.

Methods of contracting for the sale of IPP power and energy

There are three principal dimensions to power sales agreements: the selling prices for power and energy, the amount of power and energy sold, and incentives to improve performance and disincentives to ensure that performance does not fall below a basic standard. Sales agreements generally are based on a two-part pricing structure—with separate payments for capacity and energy. But there are substantial differences in the way they deal with quantities—ranging from "must-run" or "take-or-pay" contracts on the plant's entire output to competitive dispatch. The stronger a sales agreement's guarantee of a market for the IPP's output, the more attractive the IPP becomes for the IPP sponsor and financiers, but the less pressure is created to generate that output efficiently and the less competitive pressure is applied to other generators. The choice of contract structure must therefore take into account the two—sometimes conflicting—aims of attracting private finance and improving sector efficiency.

The price of capacity in the power sales agreement usually is related to the capacity declared available, rather than to the actual capacity run. It is likely to be set so that, at a given level of operation, the discounted revenue from capacity payments will cover capital costs over the life of the project. Contracts tend to set a target level for availability (say, 80 percent) over the year, plus a bonus zone above this availability and a penalty zone below it. Setting the target well below the feasible availability under good operating practices reduces the financing risk of the IPP and thus the incentive for the operators to be efficient. If the IPP is one of the lowest-cost generators, it should be used as much as possible. A bonus payment for availability above the target can be used as an incentive for higher production. Similarly, if the price for capacity allows an IPP to earn an economic return on capital at a capacity utilization below the target, penalties are needed to ensure that the IPP remains efficient. Recent U.S. experience with IPPs shows that, in most cases, penalties and bonuses are an important part of the incentive scheme.

The price of energy usually is tied to an initial cost estimate and a series of cost indexation factors. An initial heat rate and initial fuel and operating and maintenance (O&M) costs are assessed for the plant, together with the appropriate indexes (for example, the consumer price index for O&M costs and the average fuel price index of the sector for fuel costs). These determine the energy price. Often, the price is set to just cover such costs, and as long as the indexes track the actual costs exactly, there will be no change in the net revenue per unit of energy supplied. The energy price is then designed, as in certain U.S. power pools, so that the IPP is indifferent to whether or not it is dispatched. The capacity price is collected because the plant was declared available, not because it actually ran, and since it earns no net revenue per unit of energy, there is no gain from being dispatched. If strong enough, the profit motive can encourage the firm to try to "beat the index" in fuel purchases or O&M costs so that the firm's actual costs rise less than its allowed costs. (The firm is allowed to keep the difference—it is not passed on to the consumer.)

The contractual arrangements for determining how much energy and power are sold can vary greatly. The rest of the Note examines their importance for the sector.

Must-run or take-or-pay contracts

The least risky form of contract for IPPs guarantees the sale of a stipulated amount of power and energy for the life of the contract. When this guarantee covers the entire projected output of the plant, the IPP has an assured market that it cannot lose without compensation, but it also cannot increase its market share. Under this must-run contract, there is no issue of economic dispatch for the plant even when other plants have lower costs. The subsequent entry of additional IPPs, each with a long-term contract, can compound this problem. The purchaser must pay for any contracted output that it does not take from the IPP.

This arrangement has three separate effects on the performance of the sector. First, there is *no competitive pressure* for the IPP to lower costs, so that efficient operation depends *solely on the profit motive*. For costs that are indexed, the incentives to improve performance center on "beating the index" to benefit from the difference. Second, dispatch can occur out of merit order, leading to the loss of a system's productive efficiency. And third, the lack of competition for market share between the IPP and other generators means that, even if operated efficiently, the IPP poses no threat to other generators because it has no spare capacity to capture their market share. In the United States, early PURPA[1] projects were of this kind, and the result was such problems as excess production of off-peak energy, which the buying utility was obligated to purchase. The IPP projects in the Philippines are on a take-or-pay basis, as is a project in Belize and another in Colombia.

Economic dispatch

The natural development from must-run contracts has been to introduce economic dispatch. In these contracts, capacity price is again related to availability, and the energy price is paid only for the energy dispatched according to costs. The IPP can declare its available capacity and thus can cover its capital costs, but it is not guaranteed energy sales. Under this form of contract, the plants are dispatched according to their economic ranking. That is the main benefit of the arrangement, but it requires establishing an entity to determine dispatch on a cost-related basis. Energy prices linked to a cost index, however, do not allow cost savings to be passed on to consumers or reflected in the prices that influence dispatch decisions. That is because this arrangement bases dispatch on the contractual energy costs, which relate to the initial settlement level and the values of the indexes since the start of the contract. If the initial costs (for example, the heat rate) were incorrectly estimated or if the fuel prices obtained by the IPP diverge from the index, the actual cost of generation can be quite different from the cost taken into account for dispatch. In this case, dispatch might not occur according to a true merit order, and systemwide generation costs could be unnecessarily high.

The use of bonuses and penalties for capacity availability can lead to some competitive pressure between plants. If the IPP tries to increase its market share by bidding a higher availability (under the incentive of a bonus payment), other generators may lose market share and respond by trying to reduce their capacity costs so as to improve their availability. Dispatch based on economic costs, however, provides no competitive incentives for the supply of energy. Because generators cannot bid market prices, but instead offer cost-related prices determined at the outset of contracts, there is no way for IPPs or for other generators to increase market share through price competition. Contracts that guarantee a "minimum take" below normal capacity availability combine aspects of the must-run contract with those of an economic dispatch contract. Economic dispatch is used in IPP contracts in Jamaica and the Dominican Republic, and a second project in the Dominican Republic has take-or-pay for up to 130 megawatts (MW) of its 185-MW capacity.

Generator trading

Another step to improve efficiency is to allow generators to trade in a market based on economic dispatch. The contract prices for energy are predetermined for all generators, but the generators bid availability for the next period (typically the next day). The dispatch agency or power purchaser determines least-cost dispatch on the basis of the contract prices and announces the schedule. Generators can then trade energy among themselves, buying from lower-cost generators not fully committed in dispatch to meet some of their contractual commitments.

Opportunities for trade emerge when actual costs for energy are below the contract prices. The power purchaser is informed of such trades and adjusts the dispatch schedule while paying in accord with the original schedule. This system lowers the total costs of generation, but once again these benefits are not passed on to con-

sumers, because generator prices are tied to the cost index. The system can lead to competitive pressure for generators to improve efficiency once actual costs start to diverge from the index. But it is complicated to operate because the power purchaser must determine dispatch in advance and keep records of transactions between companies, and generators need to have sophisticated systems. Generator trading is used in the reformed power sector in Chile.

Competitive pool

The distinctive feature of competitive pools (as they exist in England and Wales, Argentina, the ELEX pool in New South Wales, and, to a limited extent, Norway) is that *prices for energy are bid rather than related to costs by a formula.* That allows prices to be lowered when there is real competition, as generators struggle to increase or to hold onto their market shares. Generators bid their capacity availability and their offered energy price. The pool operator then determines economic dispatch and pays for energy on the basis of marginal bid prices and for capacity on the basis of declared availability and a formula that gives signals for long-term investment. In principle, this system can be highly efficient in producing the lower consumer prices associated with competition. But experience in the system in England and Wales suggests that there are many problems associated with setting up and running such a pool. This demanding system is probably feasible only for a sizable market with several generators and sophisticated management.

Conclusion

Introducing independent power producers in a power system where existing generators are inefficient can bring about more efficient investment, but it is not sufficient to achieve the operating benefits of competition. Power and energy sales contracts are crucial to ensuring efficient operation of the IPPs, true merit order dispatch to achieve least-cost generation with current operating practices, and competition among generators to ensure efficient operating practices throughout the sector.

Take-or-pay contracts, although attractive to producers because they remove demand risk, achieve none of these benefits. Economic dispatch contracts, possibly coupled with minimum-take provisions, can be designed to provide incentives for the IPP to generate efficiently and can ensure merit order dispatch on indexed costs. Where dispatch is related to a predetermined cost index, however, there is no competition between generators to sell energy. But including a bonus in the capacity price structure can create limited competition for the sale of capacity declared available. Generator trading can ensure that dispatch occurs on the basis of actual costs. Where these costs are likely to diverge substantially from the cost indexes used in the IPP contract, generator trading can be an attractive option if there are enough generators to create a true market and a pool of suitably qualified managers to operate the system.

Full competition through an open pool is suitable only for large, mature systems with spare capacity. Even in the system in England and Wales, generators have taken several years to learn how to benefit fully from the complexities caused by rapid changes in prices. These prices sometimes have been too high because the two dominant generators have taken advantage of their market power, restricting the capacity offered to the market to drive up the price of available capacity.

Among developing countries, only the largest can expect to establish systems that bring the benefits of true competition, such as a competitive power pool or generator trading. Countries with small power systems (about 90 have less than 500 MW) that are growing slowly could introduce IPPs only slowly. Here, the need to provide low demand risk to potential investors (to compensate for the other risks of doing business in unfamiliar markets) suggests using long-term contracts that are carefully designed.

PURPA is Public Utility Regulatory Policies Act (1978).

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