NUCLEAR CAPACITY AUCTIONS

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Overview

The decision of the Swedish Parliament in 2010 to open up for new nuclear power marks a u-turn in the country's nuclear policy. The previous 30 years the official policy had been full abandonment. The reactors were to be phased out as fast as the energy system permitted, bearing in mind the consequences for employment and economic welfare. The fundamental role played by nuclear power – it accounts for some 45% of Swedish annual production – can help explain why only two out of twelve reactors have been decommissioned.

In light of the nuclear policy reversal and the uncertain future of nuclear power, the main questions are: how much new nuclear power should there be? How will investment, if socially desirable, come about? In a liberalized electricity market, producers invest in capacity if and only if privately profitable. But incumbent owners of Swedish nuclear power may have insufficient investment incentives. Three of the largest power companies in the market, E.ON, Fortum and Vattenfall, share the ownership of all three Swedish nuclear plants and jointly decide about investment. Because of their size, every new reactor lowers market prices. Market concentration implies a risk that investors internalize a large share of the subsequent profit loss on current production resulting from the new reactors. Exercise of such long-run market power leads to underinvestment and excessive electricity prices.

Long-run market power is usually curtailed by imports or by new producers entering the market. But import capacity is limited by bottlenecks in the transmission network. And entry barriers are significant, as incumbent producers in practice control nuclear investments even under the new Swedish legislation: at most ten new reactors can be built, one for each of the reactors currently in operation; a new reactor cannot be set into operation until an old one permanently shuts down; and all new reactors must be located at the three current nuclear sites owned by the incumbent nuclear producers. We propose nuclear capacity auctions as the key to unlocking the market for nuclear investment.

Methods

We use auction theory to illustrate pros and cons of a nuclear capacity auction in an environment where an incumbent producer has market power in its investment decision. In a nuclear capacity auction, the seller, say a government agency, auctions off a license to build and operate a nuclear reactor. The winner commits to constructing and operating the reactor according to specifications. Compared to a situation where nuclear investment is delegated to incumbents, the auction mitigates long-run market power by introducing competition in the investment stage. Thereby the license may be allocated to a more efficient bidder - either in terms of lower investment costs or because the bidder expects to be able to produce more efficiently than its competitors. The bids also reveal information about the economic viability of nuclear power. In particular, the license remains unsold and no new nuclear power is built if bids are too low.

Results

An auction is likely to produce a more efficient result the larger the set of bidders because the expected minimum investment cost is lower and bidding competition is fiercer, the more bidders are active in the auction. And the mere threat of entry mitigates incumbents' incentives to bid for market power. Still, producers usually fail to account for the investment's effect on consumer surplus. A bidding consortium of producers and industrial consumers would partly align consumer and producer interests in the bidding process. Thus we recommend to encourage as many bidders as possible to participate in the auction, not only entrants but also incumbents and energy intensive industry, in bidding consortia for nuclear capacity. Joint ownership by incumbent producers exacerbates underinvestment because the opportunity cost of new nuclear power increases. We thus also recommend to avoid the participation of more than one incumbent producer in each bidding consortium, if possible.

Incumbent producers may also be willing to pay a premium on the license for the opportunity to exercise short run market power. Incumbents bidding for short term market power distort the auction. The standard remedy is to modify the auction (e.g. Jehiel et al., 1996). We propose a more practical solution: require the licensees to sell a significant share of their capacity as virtual power plant (VPP) contracts (see Ausubel and Cramton (2010b) who give a detailed account of existing VPP auctions). A VPP contract is an option which gives the holder the right to purchase the contracted amount of electricity from the producer at marginal production cost. VPP contracts effectively delegate the production decision to the buyers of the contracts and thereby mitigate short-term market power and the incentives to bid for it.

The profitability of nuclear investment depends not only on market conditions, but also on current and expected taxes. One problem is that policy makers have an incentive to increase taxes once the plant is in operation and investment costs are sunk. Swedish authorities have for instance increased the tax on installed nuclear capacity several times over the years. A novel finding is that investors may protect themselves against tax expropriation by selling long term supply contracts at nuclear marginal production cost *prior* to setting the plant into operation. Long term contracts help investors secure financing of the power plant and simultaneously reduce operating profit susceptible to expropriation.

Conclusions

We propose nuclear capacity auctions as a means to improve investment incentives. In particular, capacity auctions open the market for large-scale entry by outside firms. While capacity auctions specifically for nuclear power have not been done before, they are not conceptually new. Brazil, Chile, Colombia and New England (Ausubel and Cramton, 2010a; Moreno et al., 2010) auction long-term supply contracts with the purpose of ensuring adequate reserve capacity for periods of scarcity and stimulating investments more generally. Markets for reserve capacity are under discussion in several European countries. The spot market for electricity alone is thought to provide insufficient investment incentives for reserve capacity because price ceilings or interventions prevent spot prices from reaching the levels necessary to render investment profitable.

Because nuclear marginal production cost is low relative to market prices, and provided nuclear power owners act competitively in the short run, reactors will produce at full capacity most of the time. Thus, new nuclear power would be profitable at prices way below any price ceiling. Instead, investment incentives are distorted because of long-run market power, entry barriers and political risk. This paper sketches some desirable properties of nuclear capacity auctions. More work needs to be done in pinning down the specific details of the auction design. In our view, a key factor to attract investors is a long run commitment to a nuclear policy which enables entrants, not only incumbents, to profitably invest in nuclear power. Organizing nuclear capacity auctions would contribute to such a commitment.

References

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