

Load-Following Forward Contracts

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Electricity is commonly purchased and sold in wholesale (spot) markets. The price of electricity can vary widely in such markets, depending on prevailing demand and supply conditions. Forward contracts can avoid the volatility of wholesale market prices by specifying in advance the unit price at which electricity ultimately will be delivered. Swap forward contracts (SFCs) are common in the electricity sector. A SFC obligates a supplier (e.g., a generator) to deliver a specified *amount* of electricity in return for a fixed payment by the buyer (e.g., a load-serving entity (LSE)).

Load-following forward contracts (LFFCs) are becoming more popular in the sector. A LFFC obligates a generator to deliver a specified *fraction* of the LSE's ultimate demand for electricity at a pre-determined unit price. To illustrate, under a LFFC, an LSE that is committed to serve the demand of its retail customers might agree to pay a generator a pre-specified unit price for 10% of the customers' realized demand for electricity.

SFCs and LFFCs both promote lower wholesale prices by reducing the amount of output a generator has exposed to the wholesale price. The generator's corresponding reduced concern with declines in the wholesale price motivates the generator to increase its supply to the wholesale market, which reduces the equilibrium price.

LFFCs differ from SFCs by automatically tailoring a generator's forward commitment to the realized demand for electricity. In particular, a generator that signs a LFFC commits itself to remove more output from exposure to the wholesale price as realized demand increases. The generator thereby commits itself to compete particularly aggressively in the wholesale market when demand is high and less aggressively when demand is low. Such tailoring of competitive aggression to realized demand can be valuable for a generator because increased wholesale output can be particularly profitable when the demand for electricity (and thus the generator's equilibrium profit margin) is pronounced.

The ability of LFFCs to tailor a generator's competitive aggression to realized demand can promote their widespread adoption. We show that in a setting designed to reflect conditions that prevail in the wholesale electricity market in Alberta, Canada, risk neutral generators adopt LFFCs exclusively when they have the option to sign LFFCs, SFCs, or both.

The equilibrium adoption of LFFCs serves to increase expected consumer surplus and total surplus above the levels that arise in the absence of forward contracting. However, equilibrium expected consumer surplus and total surplus fall below the levels that would arise if SFCs were the only feasible forward contracts. The reduced consumer surplus and total surplus reflect: (i) the relatively limited competitive aggression that LFFCs induce when realized demand is low; and (ii) the fact that generators tend to sign fewer LFFCs than SFCs because the former enable generators to achieve profit-maximizing levels of aggression with a relatively small level of forward contracting.

Thus, relative to SFCs, LFFCs promote reduced variation in wholesale prices but higher expected wholesale prices. Further research is required to determine when the former benefit to risk averse parties exceeds the latter cost.

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