

Setting the Energy Bid Floor

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Outline of Talk

- Factors to consider in setting an energy price offer floor or cap
 - Limit the harm to consumers
 - From suppliers to exercising unilateral market power
 - Limit the harm to market efficiency
 - Because market participants are unable to express their true willingness-to-supply energy
 - Limit harm to system reliability
 - Because market participants less like to follow schedules or respond to dispatch instructions
- Symmetry in setting offer floors and ceilings

Limit Harm to Consumers

- In multi-settlement market suppliers with substantial ability to exercise unilateral market can have incentive to use this ability to lower market price
 - Supplier facing a steep residual demand curve has a significant ability to exercise unilateral market power
 - A supplier that expects to produce less than its final schedule has an incentive to use ability to exercise unilateral market power to make market-clearing price as low as possible
- Hourly payoff of supplier in multi-settlement market
 - $\Pi(p_{DA}, p_{RT}) = P_F Q_F + (Q_{DA} - Q_F) P_{DA} + (Q_{RT} - Q_{DA}) P_{RT} - C(Q_{RT})$
 - P_F = long-term contract price, Q_F = long-term contract quantity
 - P_{DA} = day-ahead price, Q_{DA} = day-ahead quantity
 - P_{RT} = real-time price, Q_{RT} = real-time quantity
 - $C(Q_{RT})$ = total cost of producing Q_{RT}
 - If $(Q_{RT} - Q_{DA}) < 0$, then $P_{RT} < 0$ (and the larger in absolute value) maximizes profits from participating in real-time market
 - Forward contract and day-ahead prices or quantities are both known by close of day-ahead market

Limit Harm to Consumers

- Conclusion—Offer floor limits ability of suppliers to exercise unilateral market power by driving prices down in a subsequent market
 - Suppliers with substantial fixed-price long-term forward contract obligations relative to their day-ahead schedule have incentive to drive day-ahead prices below zero
 - Suppliers with substantial day-ahead schedules relative to real-time production have incentive to drive real-time prices below zero
- Suppliers are unlikely to have forward contract quantities larger than their day-ahead schedules
- Suppliers are more likely to have day-ahead schedules that are larger than real-time production
- Conclusion--Exercising unilateral market power by driving prices down is more likely to occur in real-time market
- Offer floor protects against this exercise of unilateral market power

Limit Harm to Consumers

- Setting a high offer cap can result in substantial wealth transfers from consumers to producers
 - If consumers have no ability to benefit from reducing their consumption during high priced hours of the day
- Conclusion—Lack of hourly meters and retail prices that pass through hourly wholesale price in hourly retail price is argument for a lower offer cap
 - Also an argument for a higher offer floor, because consumers also cannot benefit from consuming more during hours when prices are lower
 - Under fixed retail price, customers receive the same reduction in their monthly bill by reducing consumption by 1 KWh during any hour of month
- All consumers of three investor-owned utilities in California should have interval meters by end of 2011
 - If default dynamic pricing is implemented then there is less rationale for low offer cap and high offer floor

Limit Harm to Market Efficiency

- Setting too low of an offer cap or too high of an offer floor may prevent suppliers from expressing their true willingness to supply in their offer curve
 - True willingness to supply additional energy from a fossil fuel unit with unloaded capacity is the marginal cost of producing an additional MWh
- Supplier with no ability to exercise unilateral market power may be willing to pay a substantial price (submit a negative offer price) to remain on during a single hour or group of hours
 - Turning off in current hour prevents supplier from earning substantial variable profits in subsequent hours because once unit is turned off it cannot immediately be turned on
 - Large, slow-moving generation units with long minimum downtimes and/or long start-up periods and low variable costs of production should be willing to pay to remain on for short-periods of time
 - Nuclear power plants and large fossil fuel-fired facilities
- Suppose generation unit owner would earn variable profits of \$10,000 to remain on for remainder of day
 - If minimum generation level for unit is 200 MWh and variable cost is \$10/MWh, then unit owner would be willing to pay as much
 - $\$40/\text{MWh} = (\$10,000 - 200 \text{ MWh} * \$10/\text{MWh}) / 200 \text{ MWh}$ to remain on during current hour
- Conclusion—Setting too low of an offer price can prevent this type of generation unit owner from submitting their true offer price

Limit Harm to Market Efficiency

- This logic does not apply to wind and solar resources
 - These resources can stop and start production very quickly
 - How much energy is produced depends on availability of wind and solar energy
 - Producing less in one hour does not limit ability of supplier to produce more in subsequent hours
- Primary reason these resources are willing to produce during periods of negative prices or submit negative offer prices (if they are not under PIRP) is because of unique financial incentives they face
 - Production tax credit pays intermittent resources at least \$21 per MWh
 - Renewable Portfolio Standard (RPS) contracts guarantee renewable energy suppliers a fixed-price for all output they produce or a fixed margin (\$/MWh) over market price
 - Conclusion—Negative prices can yield positive variable profits from production of energy in current period for renewable resources
 - Different from case of thermal units where losses earned in current period are tolerated because they allow variable profits to be earned in future periods (that could not be earned if unit shut down)
- Participating Intermittent Resource Program (PIRP)
 - Virtually eliminates incentive of intermittent resource owners to reduce output during hours of negative real-time prices
 - PIRP suppliers do not submit final schedules or offer units into market, ISO's scheduling entity does
 - Imbalances between final schedule and real-time market settled on a monthly, not hourly, basis
- Conclusion—Design of renewable subsidies and PIRP program exacerbates negative price problem

Limit Harm to System Reliability

- High offer floor likely to reduce system reliability
 - Large thermal suppliers are unable to express true offer price for an hour
 - Would prefer to stay on rather than reduce output at price equal to offer floor
 - Intermittent suppliers may still wish to operate during hour because they still earn variable profits given \$/MWh subsidies they receive
 - \$/MWh subsidies greater in absolute value than offer floor
 - Limits incentives of customers on dynamic pricing tariffs to consume more during negative-price periods
- A dynamically-priced customer would be paid to consume additional energy during negative-price periods
 - With a lower offer floor, these customers have the potential to realize greater benefits from responding to hourly prices
 - Also increases system reliability by providing an additional source of “negawatt” reductions
- Conclusion—Lower offer floor likely to enhance system reliability

Symmetric Offer Floor and Cap

- Raising offer cap and lowering offer floor is likely to enhance system reliability with less harm to consumers or overall market efficiency if customers face dynamic prices and have interval meters
- This action also enhances potential benefits to consumers of dynamic pricing and greater spatial granularity in pricing
- Provides stronger incentives for suppliers to maintain units in working order to
 - Avoid imbalance charges because of unit outages
 - Sell at high prices because of unit availability

Symmetric Offer Floor and Cap

- Lower offer floor provides stronger incentives for investments in flexible generation units and storage technologies needed to manage increased amount of intermittent resources mandated by California policy
- Conclusion—Hard to argue against substantial reduction in offer cap
 - Only customers that consume less than final schedule may be harmed by large negative prices, but they have strong financial incentive to increase their consumption during these periods
- Given offer cap increases required by Federal Energy Regulatory Commission (FERC), symmetric offer cap and floor would likely increase system reliability and deliver substantial benefits to consumers on dynamic pricing plans and spur investments in technologies that allow load shifting

Questions/Comments