Reducing the Energy Bid Floor

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Outline of Talk

- Factors to consider in reducing energy offer floor
  - 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 incentive to speculate

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 real-time 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_F = day-ahead quantity
  - P_{RT} = real-time price, Q_F = real-time output produced
  - $C(Q_{RT})$ = 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
- Therefore, 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 large offer floor can result in substantial wealth transfers from producers to consumers
- Conclusion—Lack of hourly meters and retail prices that pass through hourly wholesale price in hourly retail price is argument for a higher offer floor
  - 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 soon have interval meters
  - If dynamic pricing is implemented then there is less rationale for a low offer cap

Limit Harm to Market Efficiency

- Setting too low of an offer cap 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 a 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

Limit Harm to Market Efficiency

- 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/MWh = ($10,000 – 200 MWh*$10/MWh)/200 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 $21 per MWh
  - Renewable Portfolio Standard (RPS) contracts can guarantee renewable energy suppliers a fixed-price for all output they produce or a fixed margin ($/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)
- Conclusion—Design of renewable support payments can exacerbate 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 that 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

Limits the Amount of Self-Scheduling

- Reducing offer floor should reduce likelihood that risk averse suppliers self schedule
  - Submitting price-sensitive offer curve provides risk averse supplier with a way to reduce price volatility for a given offer cap and offer floor
- Suppliers will receive higher expected profits from reducing degree of self-scheduling
  - Conversely, suppliers will lose more expected profits from not submitting price-dependent offer curves

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 in California required by Federal Energy Regulatory Commission (FERC), lower 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

Symmetric Offer Floor and Cap

- Much lower (in absolute value) offer floor than offer cap creates large positive skew in payoff to market participants
  - Suppose earn $X with probability p and lose $X*δ with probability (1-p), where $0 < \delta < 1$
  - Chose p such that expected value of this gamble is close to zero, but slightly positive so that a risk averse market participant will take it on
    - This implies $pX - (1-p)X\delta = E(\text{Payment}) > 0$
  - For a risk averse market participant, holding E(Payment) constant and letting δ get smaller (with p getting smaller to adjust for that fact) implies that the expected utility of the gamble gets larger
  - This logic implies that risk averse market participants will be more likely undertake these gambles the more asymmetric the offer floor and cap are
    - Symmetric offer floor and cap may make speculation less likely

Questions/Comments