Identifying Local Market Power Using Residual Demand

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Lin Xu, Ph.D.

Department of Market Monitoring

Market Surveillance Committee Meeting

June 4, 2010

Overview

- Objective

- Review of residual demand

- Discussion topics

  - Characteristics of the residual demand approach
  - Application in the ISO market

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Objective

- Residual demand approach was discussed as an alternative in the local market power mitigation process at the March MSC meeting.

- Objectives of this presentation are to

  - Provide background on the residual demand approach
  - Engage MSC in discussion of methodology characteristics
  - Highlight implementation factors for consideration
  - Receive feedback from stakeholders

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Residual demand

- *Residual demand function*

  - Quantity that consumers are willing to and able to purchase at any given price from *a specific supplier* considering the supply of all other market participants.

    - No transmission constraints: demand function minus the aggregate supply function of all firms besides the one under consideration.

    - With transmission constraints: the ability to purchase is constrained by the transmission network.

- *Identifies where and when a generator can influence price.*

Transmission-constrained residual demand

- *Transmission-constrained residual demand function*
  - Implicit function
  - Models transmission constraints exactly in the same way they are modeled in the market optimization
  - Considers all transmission constraints jointly
- Conceptually tracing it out:
  - solve the market optimization with the generator under consideration self scheduling q MW, and denote the cleared price by p \$/MWh, then (p,q) is a point on the residual demand curve
  - Repeat the process for various q, and connect the resulting (p,q) points

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Identify market power using residual demand

- *What does residual demand tell us?*
    - *How the market price changes if a firm withholds its output capacity*
    - *Directly characterizes the ability to alter market price*
    - *Used in assessing if a supplier has market power*
- *Scenarios*
    - Scenario 1: generator facing perfectly elastic demand
    - Scenario 2: generator facing very elastic demand
    - Scenario 3: generator facing less elastic demand
    - Scenario 4: pivotal supplier

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Market power and residual demand scenario 1 & 2
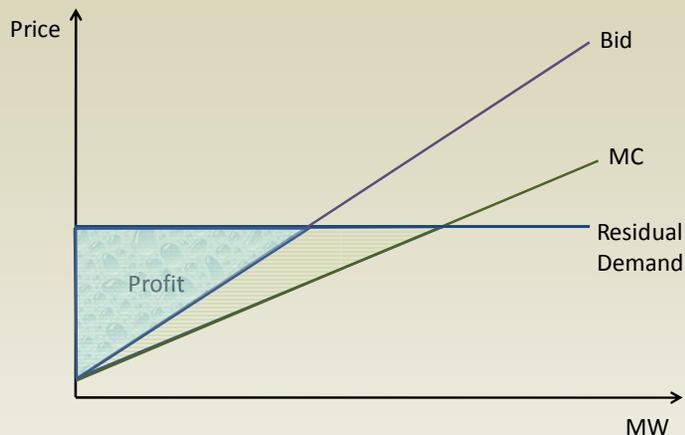
- Perfectly elastic residual demand curve.
- Supplier cannot alerter market price, and thus has no ability to exercise market power.
- Withholding will cause profit to decrease compared to competitive bidding (marginal cost).

Scenario 1: a supplier facing perfectly elastic residual demand
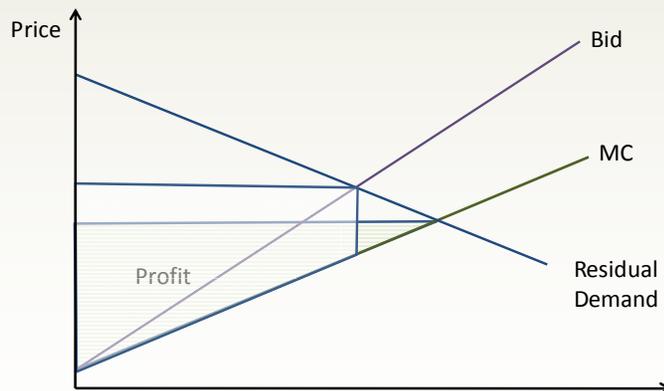
- Very elastic residual demand curve.
- Generator has market power - can profitably alter market price by withholding some capacity.
- Ability to alter price is small – requires larger reduction in quantity offered to move price a small amount

Scenario 2: a supplier facing very elastic residual demand

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Market power and residual demand scenario 3 & 4
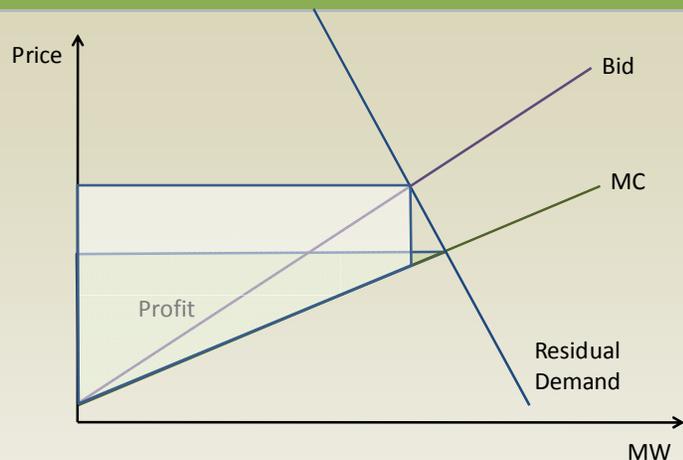
- Relatively inelastic residual demand curve
- Can profitably alter market price by withholding.
- Strong ability to exercise market power - small changes in quantity (withholding) result in large changes in price.

Scenario 3: a supplier facing less elastic residual demand
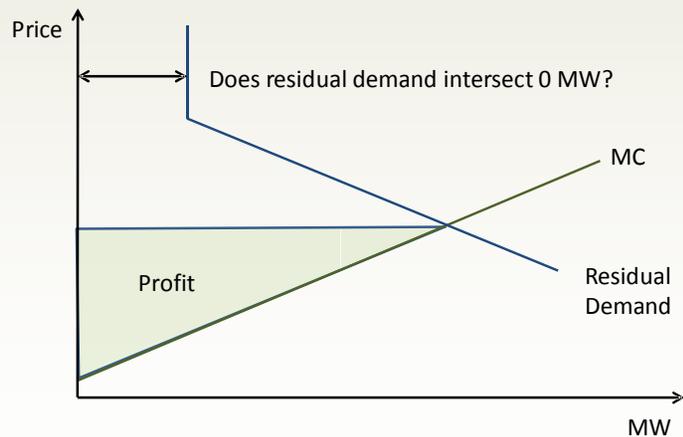
- Pivotal supplier – insufficient supply to meet demand without transmission constraints violation if the generator withholds its full capacity.
- May withhold larger quantity and receive very high price on smaller quantity sold.

Scenario 4: a pivotal' supplier's residual demand

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Discussion of general methodological issues

- How are transmission constraints incorporated into the calculation of residual demand?

- How are portfolios of resources owned by supplier at different locations in the system treated?

- For the purpose of market power detection, is it necessary to "trace out" the residual demand curve for each supplier or there are alternative simplified ways?
  - Computational time vs. accuracy?

- How does residual demand distinguish between local market power and system market power?

- How does residual demand account for multi-supplier market power?

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Discussion of potential application in ISO market

- Is this approach best suited as a primary trigger for mitigation, supplemental to existing approach or *ex post* analysis?

- Is this approach something that could be implemented in mitigation process in near-term (May 2012) or is this a longer-term option?

- Would this approach be run on-line with the market software or off-line and provide input to the mitigation process in the market?
  - On-line: More accurate bids, system, and network information, but likely to have computation time and performance concerns.
  - Off-line: Could cover more scenarios but with less current information.

- What triggers mitigation?
  - Elasticity of demand at specific points(s) < x%?
  - Elasticity of demand combined with estimated marginal cost ? (e.g. would it be profitable to exercise market power given estimated marginal cost of supplier?)

- If mitigation is triggered, which resources will be mitigated?

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