Designing a Competitive Electricity Market

5 September 2014
December 2013: Meralco’s generation cost of previous month reached P9.107/kWh, 66% higher than previous year’s level

Malampaya shutdown (11 Nov – 10 Dec 2013)
15 power plants went on outage at different times
- Lowest recorded outage: 1,182 MW (22 Nov 2013)
- Highest recorded outage: 3,505 MW (6 Dec 2013)

Bayan Muna et al. blamed the price spike to regulatory capture

650–MW Malaya Thermal Power Plant was not operated to ease power supply condition

MERALCO blamed it to market design: uniform price auction, gross pool, must–offer rule (MOR)
SCOPE FOR COMPETITION

- Wholesale Competition
  - All generators could sell power to distribution utilities and wholesale customers
    - BILATERAL CONTRACTING
    - SPOT MARKET

- Retail Competition
  - Customers can choose to purchase electricity from power marketers or directly from generators
BILATERAL CONTRACTING

Generation

Grid

ISO

Distribution

Consumers

BILATERAL CONTRACT

informal spot market

Power Flow

Contract & Financial Flow
PHILIPPINE POWER MARKET

- Generation
- TRANSCO
- Grid
- SO
- Distribution
- Consumers

BILATERAL CONTRACT

PEMC – WESM (MARKET OPERATOR)

Power Flow

Contract & Financial Flow
WHOLESALE ELECTRICITY MARKET

- Official spot market
  - Accepts Offers to Sell from generators and Demand Bids from distributors and customers

- Gross Pool
  - all energy transactions scheduled through the market

- Net settlement
  - Bilateral contract quantities settled outside the market
WHOLESALE ELECTRICITY MARKET

- Locational Marginal Pricing
  - one system marginal price but 390 nodal prices reflecting transmission losses and congestion

- Self-governance

- Mandatory market
  - Distributors must procure at least 10% of energy requirement from WESM until June 2011
WHOLESALE ELECTRICITY MARKET

- Currently operated by the Philippine Electricity Market Corporation (PEMC)
  - Formed in August 2004 as the autonomous group market operator (AGMO) to undertake the preparations for and the initial operations of WESM
  - Section 30 of EPIRA:
    - “...Not later than one (1) year after the implementation of the wholesale electricity spot market, an independent entity shall be formed and the functions, assets and liabilities of the market operator shall be transferred to such entity ...”
All generators must submit hourly offers of price and quantity
  - 7 days earlier up to 2 hours before the trading hour
If no offer is received, MO uses standing (default) offers.
Offers may contain up to 10 energy blocks
  - Min size = 5 MW
  - 1st block = minimum generation level ($P_{\text{min}}$)
  - Monotonically increasing prices
Negative offer prices allowed
  ◦ Bid cap at P62,000/MWH – (now P32,000/kWh)

**MUST OFFER** all available capacity but not to exceed registered capacity

Seller must declare bilateral quantity and identify buyer

MO issues day-ahead and week-ahead projection of load demand

Uniform price auction
PRICE DETERMINATION

P/MWH

400 MW

G1 (300, 5.0)
G2 (250, 1.5)
G3 (60, 2.0)
G4 (100, 1.0)
Market Dispatch Optimization Model (MDOM)

- Maximize total surplus subject to limitations of the power system and transmission facilities

\[ \text{LMP} = \text{SMP} + \text{cost of line losses} + \text{cost of transmission congestion} \]

- 2 prices calculated: ex-ante and ex-post
Market intervention by the System Operator and market suspension by the ERC

Conditions for market intervention (WESM rules 6.3.1.2)
(a) Significant electricity supply capacity shortfall
(b) Power system disturbance due to an outage
(c) Significant environmental phenomenon
(d) System blackout
(e) Material damage to a distribution system
(f) Government declaration of an emergency
ADMINISTERED PRICES

- Conditions for Suspension of the Market
  (i) Natural calamities;
  (ii) National or international security emergency declared by the President
MARKET OUTCOMES

- **Large Capacity Gap**
  - Of registered capacity, only 80% is available
  - Of available capacity, only 60% is offered

- **Wide price variations**
  - Oct. 2007 LWAP ex-post
    - Maximum = 29,763.43
    - Minimum = -1.51
    - Average = 3,154.47
    - 75% of the time, less than 4,000
  - Nov. 2013 LWAP ex-post
    - Maximum = 64,950.00
    - Minimum = 1,024.58
    - Average = 17,515.59
    - 44% of the time, above 10,000
MARKET OUTCOMES

- **Frequent price errors**
  - caused by undergeneration and line congestions

- **Increasing share of bilateral contract transactions**
  - Share of bilateral contract quantity
    - Oct. 2006: 55%
    - Oct. 2009: 88%
    - Oct. 2012: 92%
    - Nov 2013: 88.5%
    - Dec 2013: 85.9%
OPPORTUNITIES FOR STRATEGIC BEHAVIOR

CAPACITY WITHHOLDING

- Physical withholding
  - Declare outages
  - Reduce output
    - Technical constraints (plant equipment-related failure)
    - Fuel constraints

- Economic withholding
  - Offering a block of electricity at a price sufficiently high so that it will not be dispatched
OPPORTUNITIES FOR STRATEGIC BEHAVIOR

BREACH DISPATCH ORDER

- Undergenerate when ex-ante SMP is low to raise ex-post SMP
- Overgenerate when ex-ante SMP is high
Supply of power fell below the required contingency reserve level, but not enough to merit market intervention by the SO.

Market prices cleared at P62/kWh even during off-peak hours.
- TMO (with bilateral contracts with MERALCO) offered at P62/kWh during off-peak to avoid being dispatched due to the must-offer rule.
Could a pay-as-bid scheme avoided the price increase?
Claims

- Pay-as-bid scheme avoids the iniquity of making consumers pay more than the price generators are willing to accept.

- Pay-as-bid scheme reduces the dominant suppliers’ incentive to withhold capacity.
PRICE DETERMINATION

P/MWH

GW

G1 (300, 5.0)
G2 (250, 1.5)
G3 (60, 2.0)
G4 (100, 1.0)
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Elements of a Competitive Market

- Adequacy of reserve margins and number of competing generators

- Open access to transmission

- Portfolio management by generators
  - Limited exposure to spot market
  - Bilateral contracts for resources of different types and duration
Elements of a Competitive Market

- Customers capable of countering the market power of generators through demand responses

- Effective market monitoring and surveillance to detect market power, reduce opportunities for capacity withholding and sanction breaches of market rules