CRMs design elements

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• Advanced design of the RO mechanism
The security of supply problem
Classic reasons behind the market failure (i)

• Ideally generators can fully recover their long-term costs
  – Even although prices are based solely on operating short-term costs

• Hypotheses marginal pricing theory under perfect competition
  – An efficient short-term market
    • Competitive demand participation

• Competitive generation participation

• Efficient pricing rule

  – An efficient long-term market
    • Risk is allocated efficiently among market agents (supply and demand)
The security of supply problem
Classic reasons behind the market failure (i)

- Ideally generators can fully recover their long-term costs
  - Even although prices are based solely on operating short-term costs
- Hypotheses marginal pricing theory under perfect competition
  - **An efficient short-term market**
    - Competitive demand participation
      - Demand does not set prices: lack of participation, caps, OS intervention
    - Competitive generation participation
      - Offer caps, entry barriers (vertical integration), etc.
    - Efficient pricing rule
      - Costs are not convex and pricing rules are not optimal in some cases
  - **An efficient long-term market**
    - Risk is allocated efficiently among market agents (supply and demand)
      - Generators are risk averse and most consumers are not
    - Others: continuous investment and no economies of scale
The security of supply problem

Classic reasons behind the market failure (ii)

- The problem is long-term uncertainty not short-term volatility risk
  - Short-term volatility is not a problem for system adequacy

- The “missing planning” problem: low carbon policies have boosted the regulator intervention in the system capacity expansion

The security of supply problem

What do regulators and generators seek with a CRM?

• What does the regulator seek?
  – Secure the electricity supply
    • Attract capacity & guarantee an efficient resource management
  – Hedge the consumers risk (stabilize prices)
  – A tertiary objective: enhance competition
    • Open the market to new entrants (national or cross border)
    • Some products help mitigating market power

• What do generators want?
  – A major objective: hedge their risk
    • Hedge price risk (stable signal)
    • Have the hedge or additional income defined before the plant is built
  – If short-term signal is not optimal (price cap, pricing rules, etc.)…
    … an additional source of income may be needed
The security of supply problem
CRMs design elements

- Main design elements of CRMs

Capacity Markets
Bilat. Capacity Markets
Capacity Payments
Long term energy auctions
Reliability options
Strategic reserves
CRMs design elements

Product

• The most important design element
  – Its acquisition should lead the system to the efficient scenario

• Three main components that can combine in the definition

  Financial contract (forward, option, …)  →  PRODUCT  ←  Physical energy delivery (penalties)

  Firm supply

• Examples of products:
  – Purely financial contract
  – Firm supply
  – Financial + firm supply
  – Financial contract + physical delivery + physical back up
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Product: Reliability Option (i)

- The (financial) Reliability Option

- Purely financial (no firm supply, no penalties) -> no experience
  - Hedges price risk (both for demand and generation)
  - Financial entities can ideally sell this product
  - Physical delivery is not guaranteed
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Product: Reliability Option (ii)

• The (financial) Reliability Option

- Purely financial (firm supply but no penalties) -> Colombia
  - Hedges price risk (generator and the regulator)
  - A physical back up is required
    - The price of the RO can be higher than the value of the financial product
  - Physical delivery is more likely to be delivered
CRMs design elements
Product: Reliability Option (iii)

- The (physical) Reliability Option

- Physical Reliability option -> New England
- The penalty increases the incentive for physical delivery
  - The downside of the penalty
    - Increases the investor’s risk (increases the premium asked for the RO)
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Product

• Time terms of the contract

- Lag period: allows to fix the conditions before installing the plant
- Contract duration: sufficient durations reduce the investor’s risk

– Optimal value for these parameters are technology-dependent
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Targeted market

- **Buyers**: demand represented by the regulator
  - All the demand
    - Who should pay? -> All demand (avoid cross subsidies)
  - Only a segment of the demand
    - Important to define products that are enjoyed by the segment of the demand buying the product (avoid free riding)
    - Who should pay? -> The segment of the demand represented

- **Seller**: who can sell the product?
  - All technologies or just some (or one) technology
  - How can demand response participate?
  - Only new investments or all units?
    - Usually different conditions apply to new investments and existing units
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Quantity vs Price: defining the requirements

- Market-based mechanisms
  - Price: the regulator fixes the price (market forces decide the quantity)
  - Quantity: the regulator fixes the quantity (market forces the price)
  - Price-Quantity curve

- Need to convert a reliability standard into a requirement

- e.g. Colombia, New England, PJM…
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Mechanism to purchase the product

• Bilateral vs. auction
  – Auctions are more transparent
  – Enhance liquidity

• Centralized vs. decentralized
  – Centralizing the acquisition
    • allows exploiting economies of scale
    • at least does not add barriers to new entrants (vertical integration)
    • minimizes free riding

• Single node or zonal
  – Liquidity versus efficiency
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Mechanism to purchase the product

- Zonal auctions
  - In PJM’s RPM the clearing price for each Locational Deliverability Area (LDA, import constrained zones) is determined using an optimization-based algorithm

- In ISO-NE’s FCM a simplified clearing algorithm
  - Capacity zones are designated in advance
  - FCA begins with a single zone

Source: PJM and ISONE
The security of supply problem
CRMs design elements

• Main design elements of CRMs

The design elements inevitably affect the final outcome
The devil is in the details: success or disaster
The regulatory mechanisms

The reliability option mechanism

• Implementing a CRM mechanism is never easy

• In the reliability option mechanism
  – How to set the strike price
  – The reference market
    • When is a scarcity detected? (real-time, hour-ahead, day-ahead)
    • What if there is not market? What if there are multiple markets?
  – Consideration of previous bilateral contracts
  – How to avoid the “wait for the tender effect”?
  – How do we take into account the interconnections?
The regulatory mechanisms
The reliability option mechanism

- The problem in the regional context
  - Physical commitments are important in the adequacy problem
  - Let us imagine that the CRM-system has contracted physical reliability options from neighbouring country…
  - … and the PCR allocates all transmission capacity in the short-term

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\text{NS-I} \\
\text{CRM-system} \quad \text{Import} \quad \text{Cross border CRM-seller} \\
\text{S-I} \\
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CRM

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