

Long Run Approaches for Competition in Colombia's Wholesale Electricity Market

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*Forum on Mitigating Market Power in
Colombia's Wholesale Electricity Market*

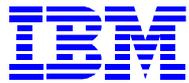
Start with a good market structure

- Don't let any participant acquire too large a share of market
 - No participant can control more than 25% of market (firm energy share)
 - If a participant's share exceeds 30%, then steps must be take to reduce share to 25%
 - Physical divestiture of firm energy
 - Virtual divestiture of firm energy

Virtual Power Plant Auctions

- EDF generation capacity auctions
 - Virtual power plants — 6 GW of French electricity
 - 37 quarterly auctions (Sept 2001 – present)
- Electrabel VPP capacity auctions
 - Virtual power plants — 1.2 GW of Belgian electricity
 - 7 quarterly auctions (Dec 2003 – May 2005)
- Endesa-Iberdrola VPP auctions
 - For the two dominant Spanish electricity companies
 - 8 auctions to date (June 2007 – present)
- Nuon VPP auction (Netherlands, one-off)
- RWE VPP auctions (Germany, quarterly)
- E.ON VPP auction (Germany, one-off)
- Elsam VPP auctions (Denmark, quarterly)
- REN and EDP auctions (Portugal, varying intervals)

EDF Generation Capacity Auctions



EDF Generation Capacity Auctions

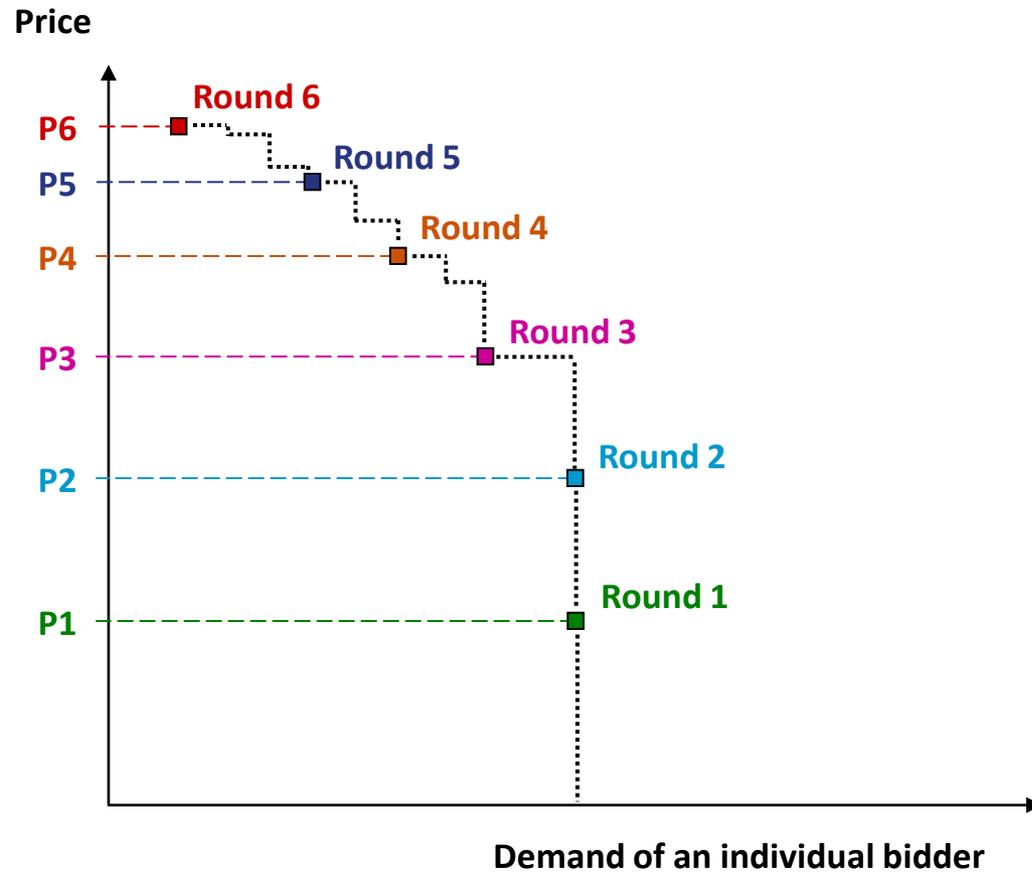
- EDF was the dominant electric utility in France, and it was proposing to acquire joint control of EnBW AG (the 4th largest German electric utility)
- In a 2001 undertaking to the European Commission, EDF committed to making 6,000 MW (updated to 5,400 MW) of French generating capacity available to competitors
- “Virtual” divestment rather than physical divestment

EDF Generation Capacity Auctions

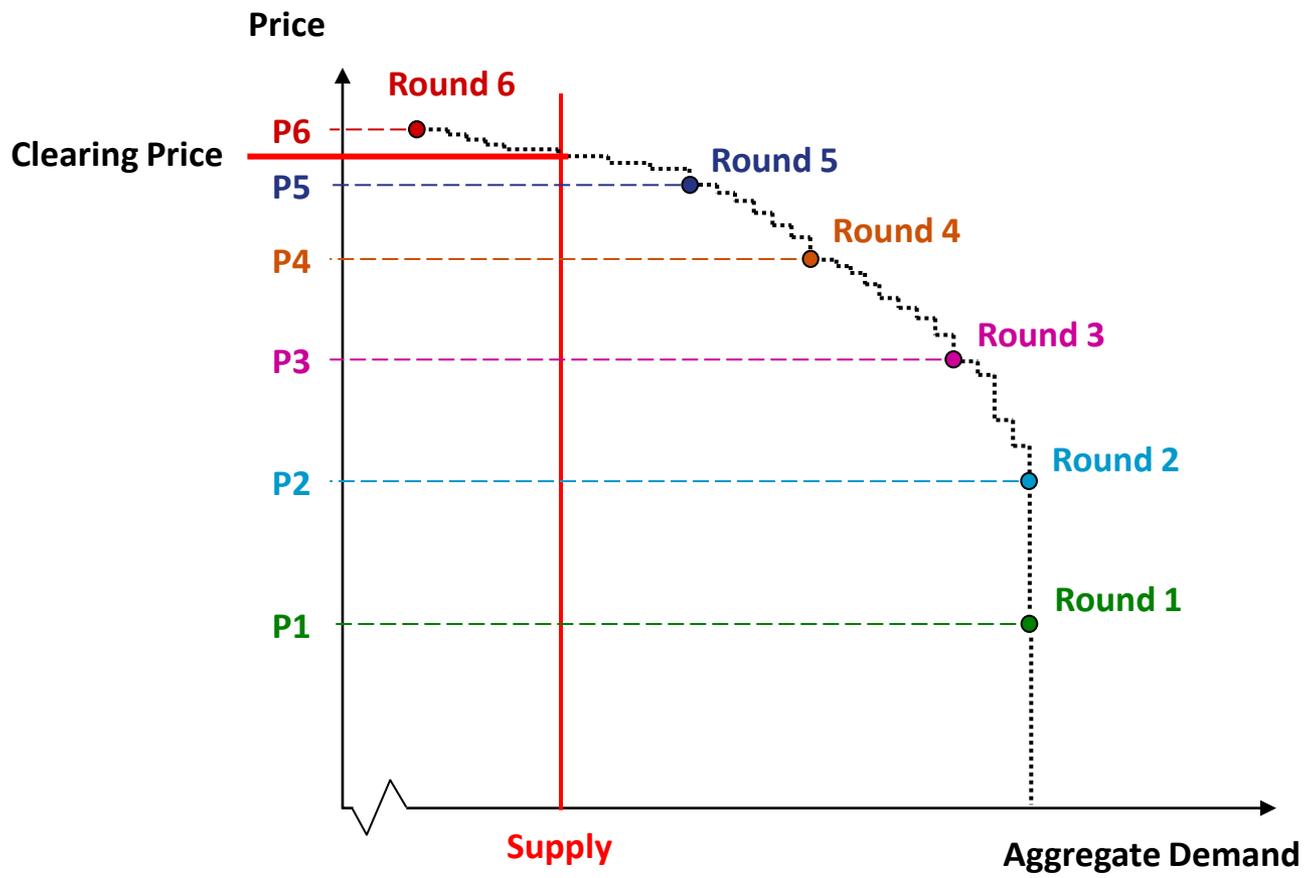
- **Two types of products: base-load and peak-load**
 - Each product is formally an option contract
 - The strike price for each type of option contract is the variable cost of the respective type of power
 - For example, in Sept 2009 auction, the strike price for base was €10/MWh and for peak was €56/MWh
- **They are auctioned simultaneously using an ascending-clock auction**

Ascending Clock Auctions

Individual demand in ascending-clock auction



Aggregate demand in ascending-clock auction



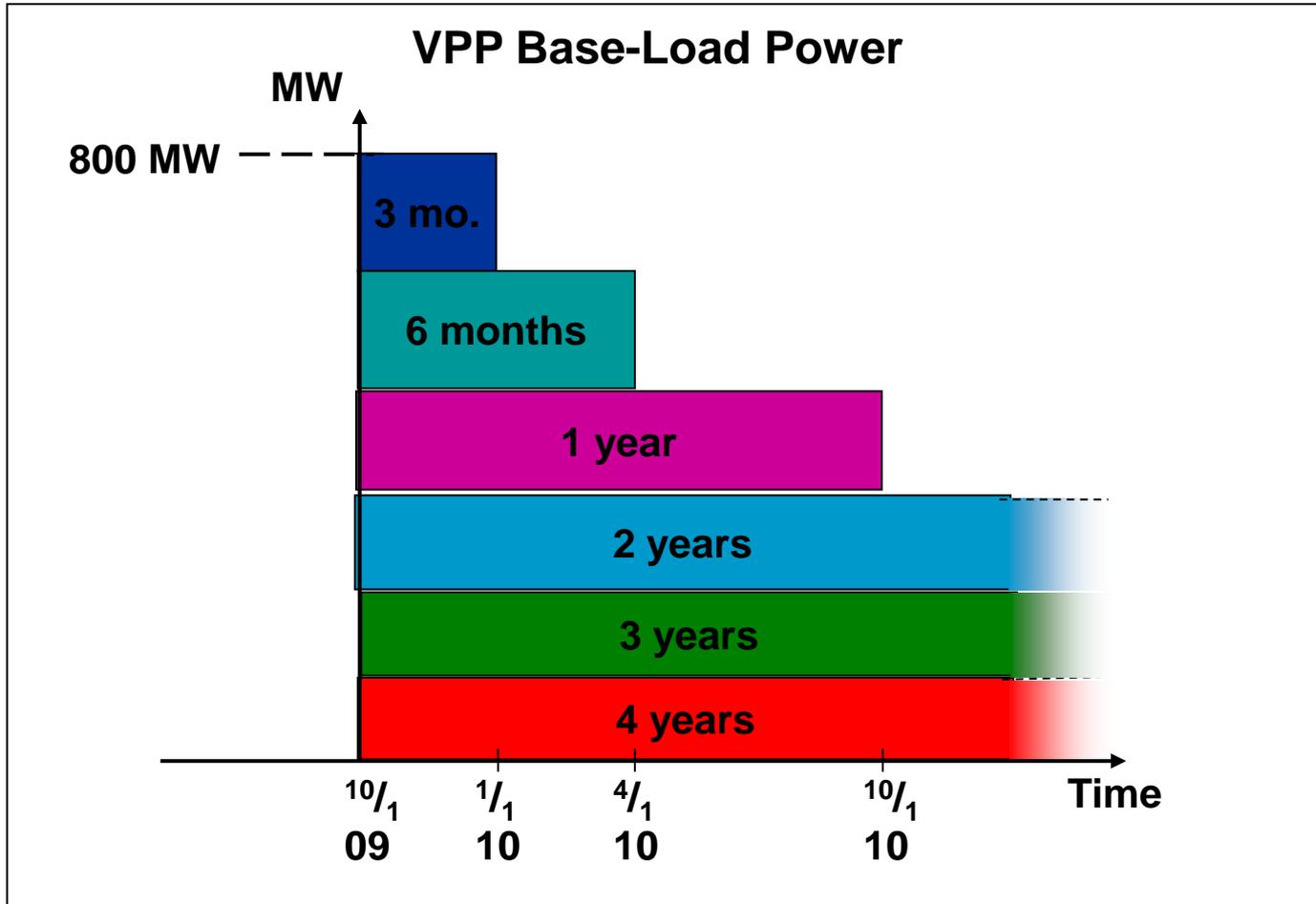
The “standard” VPP auction

- The auctioneer announces to bidders an interval of prices for each product, effective for the current round
- Bidders submit their demands for each product, at all prices in the announced interval
- After the round, the auctioneer calculates the aggregate demand, AD, at the highest price for the round
- If $AD > \text{Supply}$, then AD is disclosed to bidders and the auction proceeds to the next round (and the price interval is increased)
- If $AD \leq \text{Supply}$, then the auction closes at the lowest price such that the aggregate demand does not exceed the supply

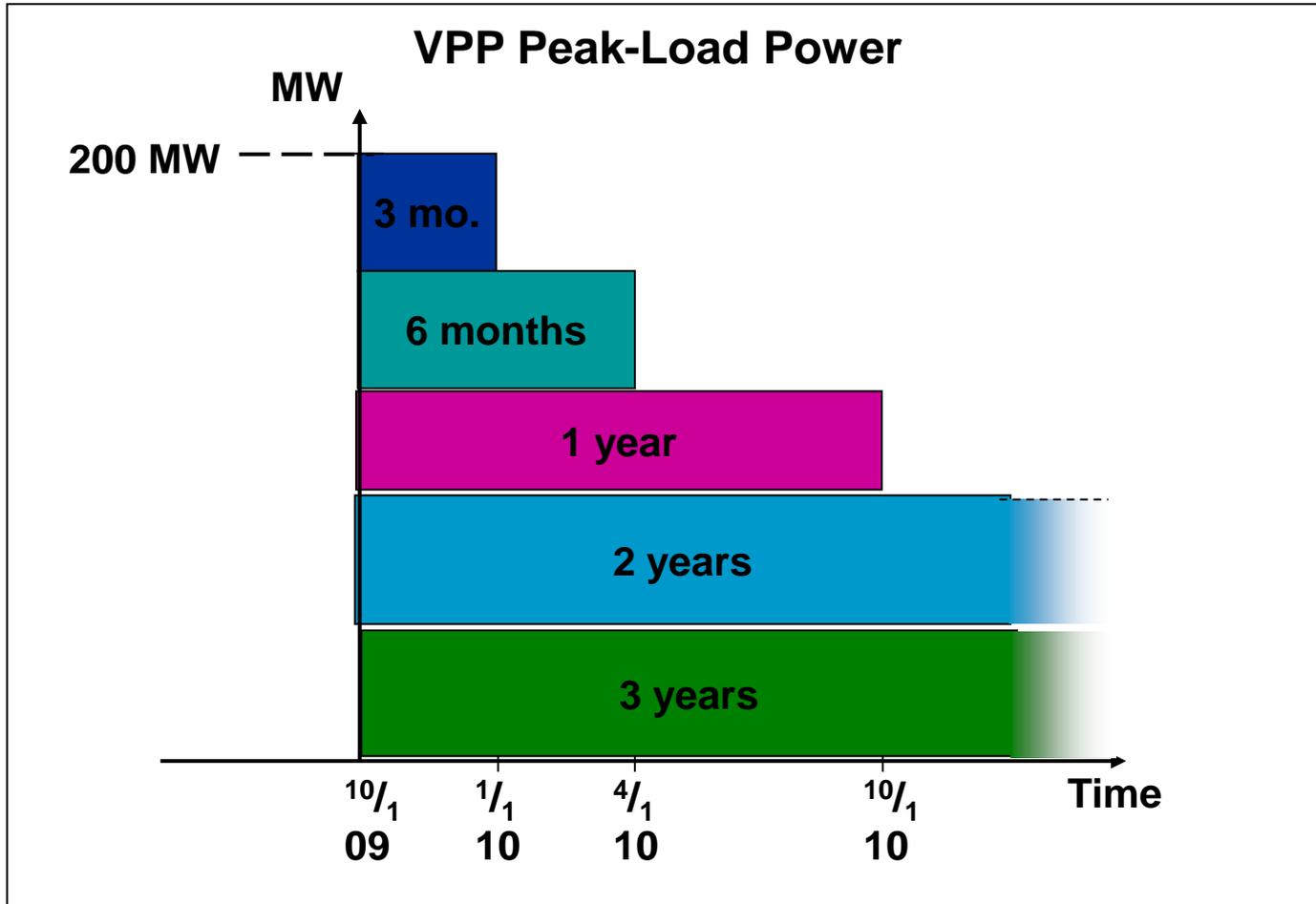
Two Product Groups

- **Product Group A: VPP Base-Load Product**
 - Six durations, all beginning 1 Jan 2011
- **Product Group B: VPP Peak-Load Product**
 - Five durations, all beginning 1 Jan 2011

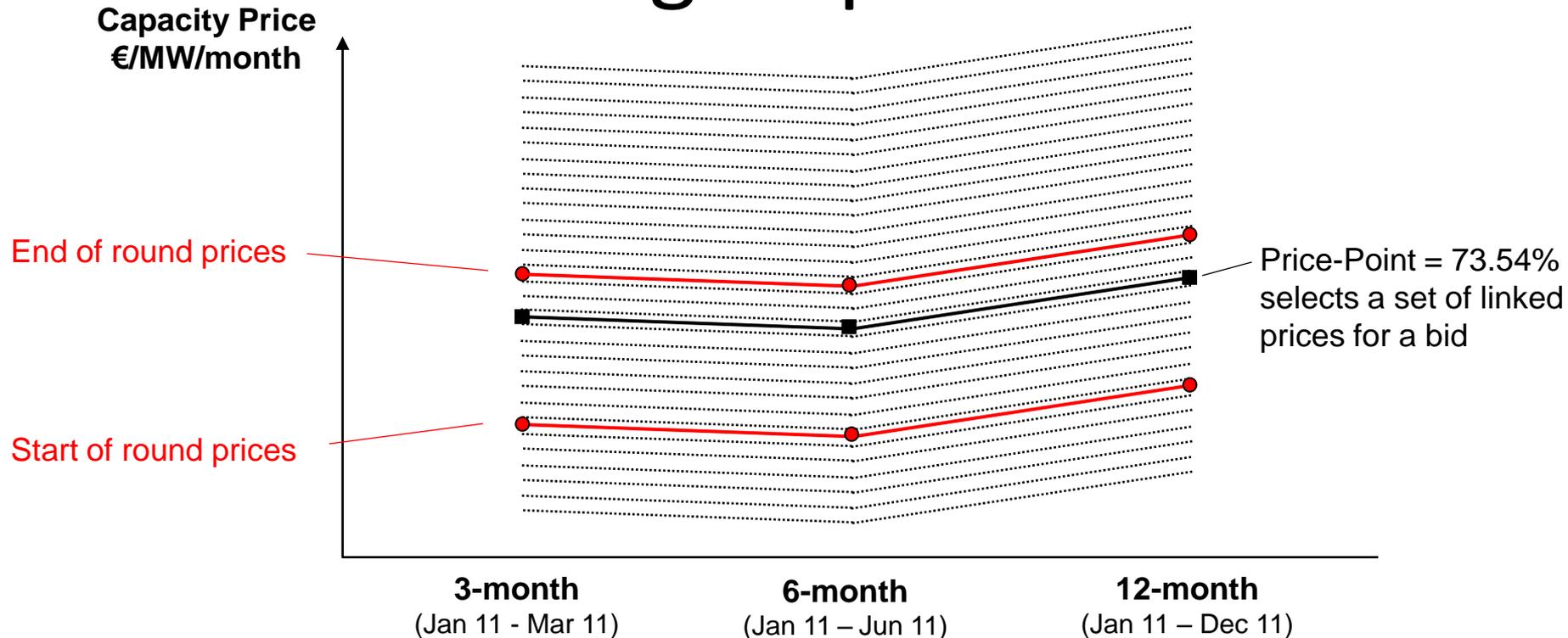
Product Group A



Product Group B



Indifference table for a product group



- Indifference table links prices within a product group – analogous to a “yield curve” for a Treasury security
- A separate indifference table for each product group (e.g. base-load and peak-load)
- Values are determined so as to make the seller indifferent among the various products

Clock auctions: Advantages over sealed bid

- Transparency
- Informational feedback makes it possible for bidders to base their bids on information revealed in the auction
- Price discovery
- With multiple related products, bidders can substitute among related products depending on prices in auction
- Enables bidders to manage budget constraints better than static auctions

Clock auctions:

Typical design features

- Auction is conducted in discrete rounds
- Activity rule: Bidders cannot increase their quantities as the price progresses (prevents bidders from concealing their intentions)
- Aggregate supply, but not individual bids, announced to bidders (makes collusion more difficult)
- Typical frequency is quarterly
- Conducted over the internet

Possible Objectives of VPP Auctions

Objectives of VPP auctions

- *Facilitating entry* into the electricity market by assuring the availability to new entrants of electricity supplies on the high-power grid
- Promoting the development of and *adding liquidity* to the wholesale electricity market
- *Reducing market power* in the spot electricity market

Facilitating entry

- Facilitating entry into the electricity market by assuring the availability to new entrants of electricity supplies on the high-power grid
 - This was the European Commission’s explicit objective in 2001
 - “The access to generation capacity will enable foreign suppliers to become active on the market for supply to eligible customers to a significant extent” (paragraph 107 of EDF’s EC Undertaking)
 - Successful in this objective
 - Example: In 2008, Iberdrola (itself required to sell in the Spanish VPP auctions) acquired 1,500 MW of capacity in VPP auctions in Germany, France and Portugal in order to become active in those markets

Adding liquidity

- Promoting the development of and adding liquidity to the wholesale electricity market
 - Successful in this objective
 - Example: In 2001, the wholesale electricity market was close to nonexistent in France — to the point that, in setting the indifference tables for the early EDF auctions, the price data was taken from the German wholesale market (the French data being too thin and lacking in meaning)
 - After eight years of VPP auctions, France is now generally considered to have about the third most active wholesale electricity market in Europe

Reducing market power

- Reducing market power in the spot electricity market
 - Not substantially, as currently practiced
 - Today's VPP auctions involve a relatively small fraction of electricity capacity in the given market
 - Bidders are typically potential entrants — not load — so their demand for VPP contracts is fairly limited.
 - Need broader forward contracting
 - However, today's VPP auctions may provide a road map on how to construct forward auctions in which load participates more widely and a larger fraction of capacity is offered, thereby mitigating market power in the spot market

Other Forward Markets

Three Markets

- Short term (hourly)
 - Spot energy market
- Medium term (1 to 3 years)
 - Bilateral contracts
 - Forward energy market
- Long term (4 to 20 years)
 - Capacity market (thermal system)
 - Firm energy market (hydro system)
- Address risk, market power, and investment

Firm energy market:
Buy enough in advance

Forward Reliability Markets

- Colombia (13 GW)
 - Hydro dominated
 - Reliability
 - Resources to supply energy in dry period
 - Product
 - Firm energy: Ability to supply energy during dry periods

Purpose of market

- Induce just enough investment to maintain adequate resources
- Induce efficient mix of resources
- Reduce market risk
- Reduce market power during scarcity
- Pay no more than necessary

Essential features

Forward procurement: in advance

- New projects compete in advance of entry
 - Coordinated entry
 - Less uncertainty in achieving target
 - Avoid boom/bust
 - New entry sets price directly
- Long-term commitment for new resources
 - Reduced investor risk
 - Better price signal for new investment

Product: What are we buying?

- Firm energy — availability of energy during scarcity events
 - Dry period (seasonal scarcity)
 - Outages (spot scarcity)
- Scarcity event defined by high energy price
 - Energy price is a *transparent* trigger
 - Energy price is a *reliable* trigger

Product is:

- Firm energy + mandatory hedge
- Firm energy =
 - Expected energy contribution to system in dry period
- Mandatory hedge = (call option)
 - Obligation follows load
 - Provides price coverage for load
 - Mitigates market power during scarcity

Same product definition for all resources including wind!

Details

- Planning period
 - 4 years ahead
 - Up to 7 years ahead for large hydro
 - Allows new entry to set price
- Commitment period
 - New resources, up to 20 years
 - Existing resources, 1 year
- Demand
 - 100% of target
- Descending clock auction
- Existing resources cannot impact price

Medium term:
Forward energy

Bilateral trade may have high transaction costs

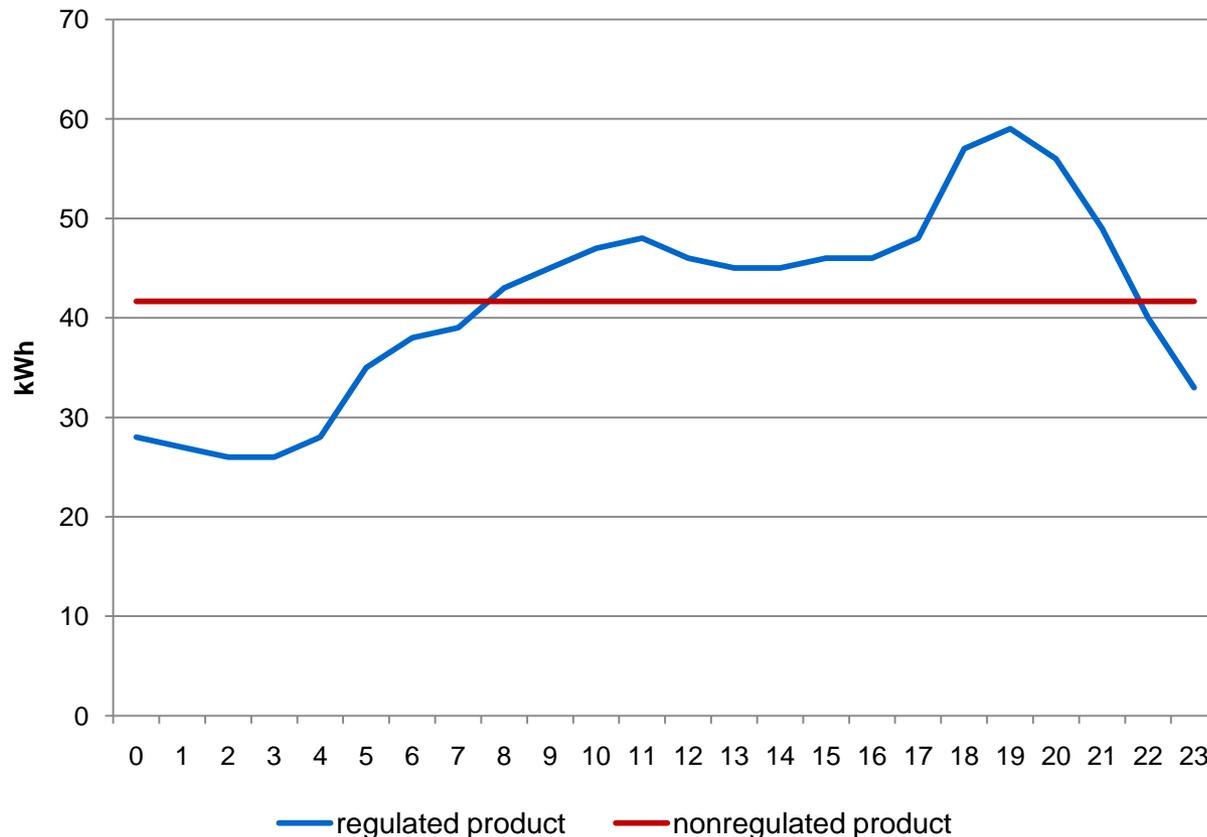
- Colombia
 - Fragmented market
 - Non-standard contracts
 - Self-dealing between Disco and affiliate
 - Contract price differences did not reflect costs

Two products, one auction

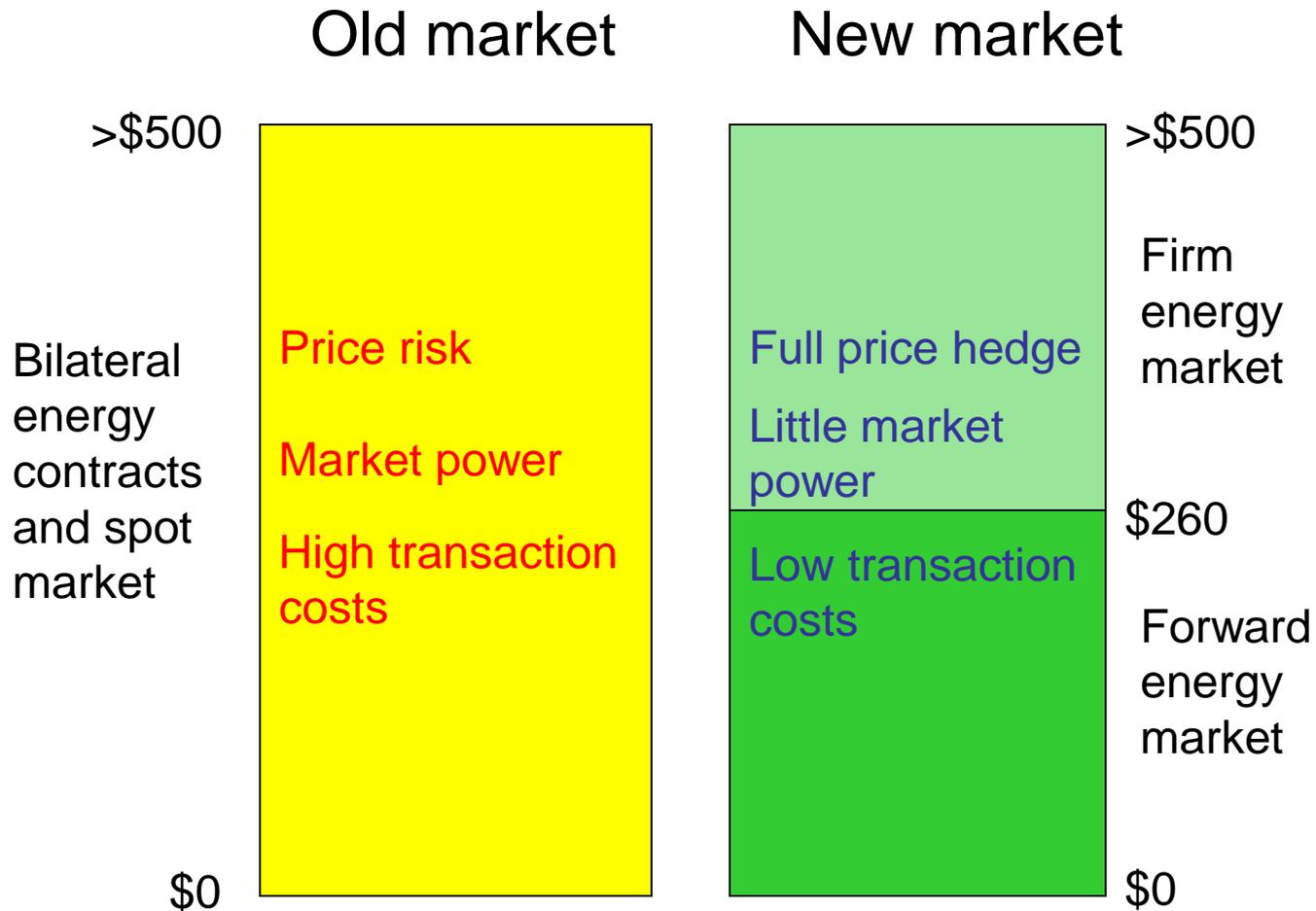
- Regulated customers (68% of load)
 - *Small* customers *without* hourly meters
 - *Passive* buyers in auction
- Nonregulated customers (32% of load)
 - *Large* customers *with* hourly meters
 - *Active* buyers in auction

Product is take-or-pay energy for 1 calendar year (1 MWh/day)

- Regulated: follows expected load shape
- Nonregulated: flat



Price coverage of regulated customer



Main features

- Demand participation
 - Regulated: mandatory
 - Nonregulated: voluntary
- Quarterly auctions 1 to 2 years ahead
- Descending clock auction
- Excellent substitution between 2 products

Conclusion

Forward markets address key problems of wholesale markets

- Investment
 - Coordinated entry to have what is needed
- Risk
 - Lock in price for capacity and energy
- Market power
 - Suppliers/demanders in more balanced position entering spot