Auctions of Contracts and Energy Call Options to Ensure Supply Adequacy in the Second Stage of the Brazilian Power Sector Reform

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Outlook

- Background
- The first “wave” of market reform in Brazil
- Difficulties with the first design
- The second “wave” of market reform in Brazil
- Energy supply contracts auctions
- Challenges
The Brazilian power system

Surface area: 8.5 million sq km
(≈ continental USA + 1/2 Alaska)
180 million inhabitants
Inst. capacity (2005): ~94,000 MW
Energy Consumption: ~400 TWh
≈ 55% of South America
comparable to UK and Italy
Peak Demand: ~60,000 MW
Energy production sources

- Thermal plants + interconnections (15%): natural gas (combined and simple cycle), coal, heavy fuel, diesel, biomass and nuclear
- Hydro (85%): large plants in cascade, in different river basins
- Hydro plants are jointly operated, to take advantage of hydrological diversity (export from “wet” to “dry” basins)
  - SDP models extensively used
Brazil: transmission system

Transmission is an important factor for the integration of hydro power production

Country is interconnected by 80,000 km of HV lines (>230 kV)

Long transmission lines (> 1,000 km)

+ international interconnections

Strong (private) transmission expansion over the last years: 15,000 km of new lines added (1998-2006), concessions awarded on a competitive basis (auctions)

Source: ONS, www.ons.org.br
Need for additional generation

• Projected annual load growth: 5%
  ⇒ 3,200 ave. MW / year (28,000 GWh)
  ⇒ US$ 6 billion/year in investments

• Brazil’s challenge: to promote efficient energy growth
Motivation for the first sector reform

• Difficulties with the previous model (state-owned, verticalized utilities)
  – Few instruments to promote efficiency:
    • “optimistic” load forecasts (political pressure)
    • Construction cost overruns (transferred to consumers)
    • Inadequate consumer tariffs (political pressure to meet inflation targets)

• Government did not have enough investment capacity to ensure the supply of an increasing load
Ingredients of the first reform (1996 - 2000)

• Privatization
• Competition in generation
• Regulated transmission and distribution
  – In addition of the regulated (wire) business, Discos also buy energy on behalf of end-users (there is a pass-through limit for tariffs)
• Short-term (“spot”) wholesale energy market
  – Cost-based dispatch
  – Energy short-run marginal costs are the proxies for the market prices
• Forward contracts: financial instruments to hedge price-risk
• National System Operator and Regulatory agencies
Capacity expansion

- Capacity expansion was supposed to be induced by a combination of short-term prices and contract obligations (85%)
- Discos negotiate freely their bilateral contracts
  - 85% contracting obligation
  - Benchmark price as pass-through limit (defined by the regulator)
The happy years... (1998 – 2002)

- Strong interest by foreign investors and very successful privatizations (the electricity “bubble”)
  - discos sold with high markups
  - efficiency gains in privatized utilities
- Strong private participation in hydro concession auctions and hydro construction (IPPs)
  - more than 10,000 MW of hydro concessions auctioned
  - construction costs reduced by 30%
  - construction time reduced by 40%
- The free market for consumers increased
- Private gas/electricity interconnections
  - Argentina-Brazil (E, 2000 MW); Bolivia-Brazil (G, 30 MMm³/d)
Then the difficulties… (2001 – 2002)

- Energy rationing in Brazil for 9 months (2001-2002)
  - 20% of the load reduced in 80% of the country
  - GDP impact: 15 billion USD

- After the rationing finished
  - demand did not recover, jump from scarcity to surplus
  - Inefficient capacity purchase by discos was observed
What happened?

- Economic signals from the spot market for system expansion were not clear
  - Resulted in lack of enough new capacity
  - In addition, new generators need long-term contracts as collateral for financing (project financing structures): active forward market needed

- Difficulties to establish pass-through prices to end-users
  - Benchmark prices established by the regulator based on LRMC
  - Oscillation from periods with low benchmark prices (and no contracting) to high benchmark prices (with expensive costs transferred to consumers)
    - inefficient contracting of new capacity

- Institutional debility:
  - Examples: role of the activities of Ministry of Energy and Energy regulator
Example: inadequate “spot market” signals for system expansion

Energy spot prices are very volatile, dependent on the hydrological conditions.

Hydrological “noise” distorts the signal for new capacity needs.

It is difficult to identify the optimal timing for new investments... spot price increases only when the system is “too close” from a power crisis.
The second “wave” of market reforms in Brazil

- Less emphasis on the short-term “spot” market as provider of signals for system expansion
- More emphasis on the forward contract market to induce the entrance of new capacity
  - Competition “for the market” instead of competition “in the market”
- Strengthening of regulatory agencies
Key ingredients

1. Requirements for forward contract coverage imposed on all loads (distribution companies + free customers)
2. Improvement of contracting process to ensure generation expansion and supply adequacy
   - procurement auctions
   - forward contracts + energy call options used
   - strategies to deal with uncertainty on the load growth

• (1) + (2) = supply adequacy + efficient contracting
1. How to contract new capacity

- All consumers must be 100% covered by energy supply contracts
  - Verified ex-post, on an yearly basis
- Although supply contracts are financial (forward contracts), they must be backed by “firm” physical production capacity (“ballast” or “physical coverage”)
- The need to sign new contracts to cover additional load is the driver for the entrance of new capacity
2. How to ensure efficiency

• Discos can only acquire energy through contract auctions
  – long-term contracts reduce risks for investors and promote competition
  – benchmark prices to pass-through consumers as result of the new energy auctions

• Free consumers can do as they please, as long as they are 100% contracted
Auction scheme: overview (1 of 2)

• Discos are responsible for the load to contract
  – Penalties if not 100% contracted, pass-through limit of up to 3% of overcontracting

• Auctions are made “jointly”, aiming at contracting the totality of Discos needs
  – objective: benefits with economies of scale for new generation

• However, each new generator contracted signs separate bilateral contracts with each Disco
  – amount proportionally to the utility’s declared demand
  – it is not a “single buyer” model because the government does not interfere in contracts nor provides financial guarantees
Auction scheme: overview (2 of 2)

• Role of government:
  – auction design. Examples:
    • uniform descending price-clock auction
    • pay as bid with sealed bids
  – definition of reserve prices
  – contract design: energy forward contracts x energy call options
Types of auction (carried out yearly)

• Existing energy
  – supply current load
  – 5 to 10 year standard contracts for immediate delivery

• New energy
  – supply forecasted load increase
  – 15 to 30 year standard contracts for delivery 3 and 5 years ahead

• Criterion for contracting in auctions is the smallest tariff ($/MWh)

• Reason for separate auctions:
  – Allow discos to manage load uncertainty with a contract portfolio
  – more efficient allocation of risks among existing plants and new projects
Summary of the yearly contracting process

- Auctions for new generation (15 year contracts)
  - A-5 auction (energy delivery 5 years later)
  - A-3 auction (energy delivery 5 years later)
- Auctions for mid-term contracts => contract renewal (existing capacity)
- Auctions for long-term contracts => new capacity

Auctions for mid-term contracts => contract renewal (existing capacity)
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Year of purchase

- Auctions for new generation (15 year contracts)
  - A-5 auction (energy delivery 5 years later)
  - A-3 auction (energy delivery 5 years later)
- Existing energy (2 – 8 year contracts)
  - A-1 auction (energy delivery 1 year later)
  - Adjustment auction (energy delivery 4 months later)
Auctions so far (contract renewal – existing energy)

- December 2004
  - 8-year financial forward contracts for delivery in 2005, 2006 and 2007
  - Simultaneous multi-item auction
  - Contracted energy: 1,193,000 GWh (17,000 aMW)
  - $ in contracts: US$ 32 billion

- April 2005 and October 2005
  - 8-year financial forward contracts for delivery in 2008, 2009
  - Simultaneous multi-item auction
  - Contracted energy: 92,920 GWh (3,300 aMW)
  - $ in contracts: US$ 7 billion
Results of existing energy auctions

About 20,000 average MW contracted

Largest prior contract auction: EdF (3,000 MW)
Auctions so far (new capacity)

• December 2005
  – Simultaneous multi-item auction
  – Contracted energy: 564,000 GWh (3,300 aMW)
  – $ in contracts: US$ 15 billion
  – Strong interest by private investors:
    • 200 projects registered as supply candidates (hydro, CCGT, coal, sugarcane biomass, oil)
Novelty of this auction: contract type (2 of 2)

- Energy call options* were auctioned for thermal generators
  - A call option is the right but not obligation to purchase power over the contract duration at an agreed upon strike price (D pays an option premium)
  - Transfer to consumers “systemic” risks which are difficult for the individual investor to manage (e.g. hydrology)

*Details on: B. Bezerra, L.A. Barroso, Member, S.Granville, A. Resende, A.Street, M.V.Pereira; “Energy Call Options Auctions for Generation Adequacy in Brazil”, IEEE PES General Meeting 2006
Novelty of this auction: contract type (2 of 2)

- Generators were allowed to bid the option strike price ($/MWh) and option premium ($/year)
  - There were rules to compare options with different strikes and premiums
- This type of contract allowed the entrance of smaller investors, with a wide range of technologies (cogeneration based on sugar-cane biomass, natural gas, coal, diesel etc.)
New Energy auction results

Prices and quantities of auctions

New capacity: breakdown per energy source

- Gas: 42%
- Coal: 17%
- Biomass: 3%
- Former Emergency: 5%
- Hydro: 31%
Future auctions

• June, 29, 2006 (A-3 auction)
  – 15-year contracts for delivery in 2009
  – Single-item auction
  – Again, strong interest by local & foreign investors
    • Candidate capacity (registered) was high (14,500 MW!)

• September 5, 2006 (A-5 auction)
  – 15-year contracts for delivery in 2011
  – Single-item auction
Conclusions

• The second wave of market reforms in Brazil is focused on instruments to ensure sufficient capacity and investment to serve reliably its growing economy.

• The use of auctions to contract energy is a positive move, as it promotes transparency, reduce risks for investors and increases competition.
  – Contracting in advance facilitates project financing
  – Auction design is important to avoid market power

• Auctions have been attracting a large and quite diversified candidate supply (hydro, gas, coal, sugarcane biomass, international interconnections, oil), which is a positive sign.
  – the use of energy call options helped to increase competition
Challenges and next steps

- Integration of electricity and gas regulatory frameworks
- Environmental constraints
- Regulatory stability

Investment cycles (15 to 30 years)

Political cycles (4 to 6 years)

Unstable political cycles (indefinite duration)

Source: Cambridge Energy Research Associates.
Ongoing program: bioelectricity initiative

- Joint initiative of sugarcane producers, cogen associations and equipment manufacturers
  - Install from 3 to 5 thousand MW of biomass cogen in the next five years
  - 100% private investment
  - Compete with other sources on the same footing
- About 200 MW of biomass cogen were contracted in the Dec 2005 auction promoted by discos
- Opportunity for “green field” projects: sugar + ethanol (exports) + sale of electricity + carbon credits, all tied to poverty reduction programs
Thank you!

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