Design and implementation of Reverse Auction – Case study of Brazil

SAARC Knowledge Sharing Workshop on “Modern Techniques including Renewable Energy Auctions for Economizing Renewable Energy Tariff”
SAARC, Colombo, Sri Lanka, May 10th, 2018
Outline

• EPE – WHO ARE WE?

• ELECTRIC POWER IN BRAZIL

• EXPANSION PLANNING

• THE EVOLUTION OF THE RENEWABLES IN BRAZIL

• BRAZILIAN AUCTIONS SUMMARY

• RENEWABLE AUCTION LESSONS
ENERGY RESEARCH OFFICE (EPE) – WHO ARE WE?
**EPE - WHO ARE WE?**

- EPE is a governmental agency supporting the Ministry of Mines and Energy in its policy decisions, via planning studies for the energy sector. Created by law in 2004.
  - Those studies includes electric energy, oil and gas, renewables, coal, nuclear, energy efficiency, distributed generation and others
  - Technical staff of ~350 people, 65% with MSc or PhD degrees

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**Diagram**

- **CNPE** (Conselho Nacional de Política Energética)
- **MME** (Ministério de Minas e Energia)
- **CMSE** (Comitê de Monitoramento do Setor Elétrico)
- **ANP** (Agência Nacional do Petróleo, Gás Natural e Biocombustíveis)
- **ANEEL** (Agência Nacional de Energia Elétrica)
- **CCEE** (Câmara de Comercialização de Energia Elétrica)
- **ONS** (Operador Nacional do Sistema Elétrico)

- **Cabinet-level policymaking and monitoring**
- **Regulation**
- **Planning, market & system operation**
ELECTRIC POWER IN BRAZIL
Brazil
- Area: 8,515,759 Km$^2$
- Population: 208.6 million

Electricity Sector
- Transmission lines: 141,576 Km
- Generation Capacity: 157.9 GW
  - Hydro: 63.7%
  - Thermal: 26.5% (9% Biomass)
  - Wind: 7.8%
  - Nuclear: 1.3%
  - Solar PV: 0.7%

- Consumption: 557 TWh
  - Regulated Market: 70.2%
  - Free Market: 29.8%

3,000 - 5,000 MW of new additions needed per year in business as usual years

Considerable private participation in G, T & D
BRAZILIAN POWER SYSTEM IS CHANGING...

- Renewables are growing. Economic competitiveness. Complementarity with hydro.
- Balance between supply and demand must be supplied by dispatchable sources.
- Less Hydro reservoirs projects...
- ... means that thermal energy is as an option for the latent need for firm energy supply.
EXPANSION PLANNING
ENERGY PLANNING IN BRAZIL

Timeline

ENERGY PLANNING

Energy Policies

“very long term”

Expansion

Long term

Operation

Mid term

Short term

Real time

Strategic Expansion Policies

Adequacy of Supply

Firm energy supply

Security of energy supply

ENERGY PLANNING IN BRAZIL

Slide 9
PLANNING THE POWER EXPANSION

PDE
Ten-Year Energy Expansion Plan

- Medium-term View (10-years period)
- Tactical and operational approach
- Auction Programs: Power Lines and Generation

PNE
Long-term National Energy Plan

- Long-term View (30-years period)
- Strategic Approach
- Forecasts: Demand, Supply, Technology, Energy Efficiency, Energy Source Replacement
The power generation plan is **indicative**
The transmission plan is **determinative**
Should provide adequate economic signaling to the market
Balance between supply and demand
Respecting contracts and conditions of energy policies
Power Generation Expansion: **More than 60 GW until 2026** (already contracted and indicative).
THE EVOLUTION OF THE RENEWABLES IN BRAZIL
The evolution of the renewables in Brazil

Small Hydro, Wind, Solar PV and Biomass

- Hydros dominate Brazilian electricity mix
- Feed in Tariff Program
- First PROINFA’s power plants start operating
- First PROINFA’s RES-E Auction
- First Exclusive RES-E Auction (Small Hydro and Biomass)
- First Auctioned Wind power plants start operating
- First Auctioned PV plants start operating

Rationing forces a rediscussion about electricity mix, including RES-E and thermal role

Up to 2000
2001
2004
2006
2007
2009
2012
2014
2017
New Capacity Auctions: main results

New Capacity Contracted since 2005
1,167 projects
90,190 MW

39 Auctions
24 New Energy Auctions
9 Reserve Auctions
3 Alternative Sources Auctions
3 Special Auctions

Not accounted: Projects with cancelled grants, cancelled contracts.

Source: CCEE (May/2018)
BRAZILIAN AUCTIONS SUMMARY
### Auctions Summary – Companies/Entities

**Ministério de Minas e Energia**
- Ordinances - Auction Guidelines
- Declaration of needs (Utility companies)
- Grants

**ANEEL**
- Authorizing Acts
- Public Hearing
- Tender Announcement - draft of Power Purchase Agreements
- Guarantees and Penalties for participants

**EPE**
- Registration and Technical Qualification of projects
- Cap Price
- Firm energy certificate of each project
- Auction demand (reserve auctions)
- Projects Datasheet for Auction system

**CCEE**
- Preparation of Auction System
- Realization of the Auction
- Signature and Registration of Power Purchase Agreements

**ONS**
- calculates the Flow Capacity of grid
Auctions Summary – Auctions types

Auctions to attend Utility Companies demands

- Alternatives Sources
- Special Auctions
- New Energy
- Existing Energy

Reserve Auction

- Supply Adequacy
- EPE calculates the auction’s demand
- All consumers pay for it
## Auctions Summary

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
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<tbody>
<tr>
<td><strong>Why auctions?</strong></td>
<td>Auctions are competitive mechanisms that allow price discovery and can foster new technologies, especially if there is a legal, technical and regulatory framework.</td>
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</tbody>
</table>
| **The Buyers**   | **Regulated Auctions**: Utility companies that need to cover their loads  
                   **Reserve Energy**: Market operator (CCEE) with the goal of improving supply adequacy. |
| **Sellers**      | Independent Producers technically certified by Energy Research Office (EPE is the equivalent Brazilian acronym) and with bid bonds deposited on CCEE. |
| **Forward Period**| **New Energy Auctions**: 3 to 7 years  
                         **Existing Energy**: 1 to 5 years  
                         Renewables tend to participate in 3 year forward auctions |
| **Delivery Period**| Hydro: 30 years  
                       Wind, Solar PV and Biomass: 20 years |
Auctions Summary - Scheme

4-6 months to prepare an auction

- Auction Guidelines
- Registration and Technical Qualification of projects
- Registration for auction participation
- Realization of Auction (Online)
- Homologation of results and Award of Grant
- Authorization Grant
- Signature and Registration PPAs
Technical Qualification

- Technical Analysis
- Documentary analysis
- Project’s Datasheet

Diagram:
- Environmental license
- Grid Information Access
- Ownership of the land
- Resource and Energy Production
- Project and Registry
Registered Projects

![Graph showing registered projects from 2011 to 2016 with cumulative power capacity in MW.](image)
Results

Quantidade de Projetos

- Projetos Cadastrados
- Projetos Habilitados
- Projetos Vencedores

<table>
<thead>
<tr>
<th>Year</th>
<th>Projects Registered</th>
<th>Eligible Projects</th>
<th>Winning Projects</th>
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<tbody>
<tr>
<td>2011</td>
<td>36.0%</td>
<td>6.4%</td>
<td>0.9%</td>
</tr>
<tr>
<td>2012</td>
<td>71.4%</td>
<td>0.9%</td>
<td>0.9%</td>
</tr>
<tr>
<td>2013</td>
<td>62.9%</td>
<td>10.0%</td>
<td>0.9%</td>
</tr>
<tr>
<td>2014</td>
<td>70.3%</td>
<td>5.1%</td>
<td>0.9%</td>
</tr>
<tr>
<td>2015</td>
<td>62.5%</td>
<td>5.2%</td>
<td>0.9%</td>
</tr>
<tr>
<td>2016</td>
<td>65.9%</td>
<td>1.5%</td>
<td>0.9%</td>
</tr>
</tbody>
</table>
RENEWABLE AUCTION LESSONS
Lessons learned: technical qualification

• Technical requirements should be clear, objective and as simple as possible

• Diligences demand effort and time, but they can be important for the competition

• Tradeoff: strict qualification rules tends to lead to higher success levels in the implementation of the projects, but reduces competition

• Tradeoff: Track record requirements x Project quality requirements
Lessons learned: post-auction project changes

• After the auctions, it’s normal that winners make some changes in the technical features of their projects:
  • Technical and economical optimization, deals with equipment suppliers, new technologies available, international financing, etc.

• These changes doesn’t mean the technical qualification was useless... Making changes is much less risky when a project has been consistently developed
Lessons learned: confidence in the process

• Submitting a project demands time and investment for the participants: rules should not be changing all the time

• Make sure you have demand before calling an auction to avoid frustration

• Technical qualification is just one part. The financial arrangement after the auctions is also a significant challenge
Lessons learned: mixing different sources

- Brazil has many energy resources and we have aimed to have a mixed matrix – it means you don’t always buy the cheapest sources and you should adapt the auctions to have some demand met by different sources.

- Consistent metrics to compare different energy sources is important if they are competing with each other.
  - Adding attributes to the metrics of competition can be tricky and end up easy to manipulate according to subjective opinions.
Lessons learned: cap price

• The cap price can be revealed before the auction or not. In Brazil, it’s revealed before and it can attract or discourage participants in the auctions.

• The cap price is just a piece of the attractiveness of the auction:
  • Risk evaluation is a key issue: currency, grid connection, environmental permitting, regulatory environment, financing, resource availability, etc.
  • Risk allocation is everything: setting the risk-adjusted return level, product design, FX risk, etc.
Lessons learned
Regulated auctions prices: historical figures

滑动 29
Lessons learned: grid access

- Grid connection has proven to be a big issue, especially in the Northeastern region where the best wind and solar resources are located.
- At first, we used to plan and contract new transmission lines after the new capacity auctions, but delays have been common.
- More recently, a new approach: transmission planned and contracted before the new capacity auctions and projects are qualified only if there’s grid capacity.
- This demands a transmission grid capacity evaluation, which can be a complex problem.
- A new phase in the auction for competing for the available grid capacity.
Lessons learned: Pitfalls

Cancelling auctions near to auction date:
• In 2016, Brazil decided to organize auction
• Canceled the procurement at the last-minute

Construction and non-completion rates:
• Delay rate = approx. 27%
• Non-completion rate = 10%

Generation and transmission mis-match:
Power plants completed before transmission lines cost consumers approx. $1 billion USD.
More information about auctions

EPE Youtube Channel: The importance of qualification requirements for energy auctions

https://www.youtube.com/watch?v=LUXK5c2Z3d0
More information about auctions

- **Report of Brazilian Electricity Auctions in 2017**

  "Brazilian Electricity Auctions in 2017"  
  Presenting the results and how they influence energy planning studies

In December 2017 the contracting of energy from new power generation plants in Brazil was resumed, with two auctions that took place under the guidelines of the Ministry of Mines and Energy (MME). On the 18th, the “A-4” auction was conducted, for supply to begin in January 2021, while on the 20th it was time for the “A-6” auction, for energy supply to begin in January 2023.

Such auctions are part of the electricity supply adequacy mechanisms in Brazil. They have the objective of supplying the regulated market, providing long-term energy contracts for power generators, that must be backed by firm energy.

These two auctions were relevant because they have consolidated a couple of features that had been tested in previous years, such as a preliminary phase of competition for the available capacity in the transmission grid. At the same time, they were

Thank you!

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