



Markets Abroad: Learning by Looking

The Brazilian Experience in the Electricity System

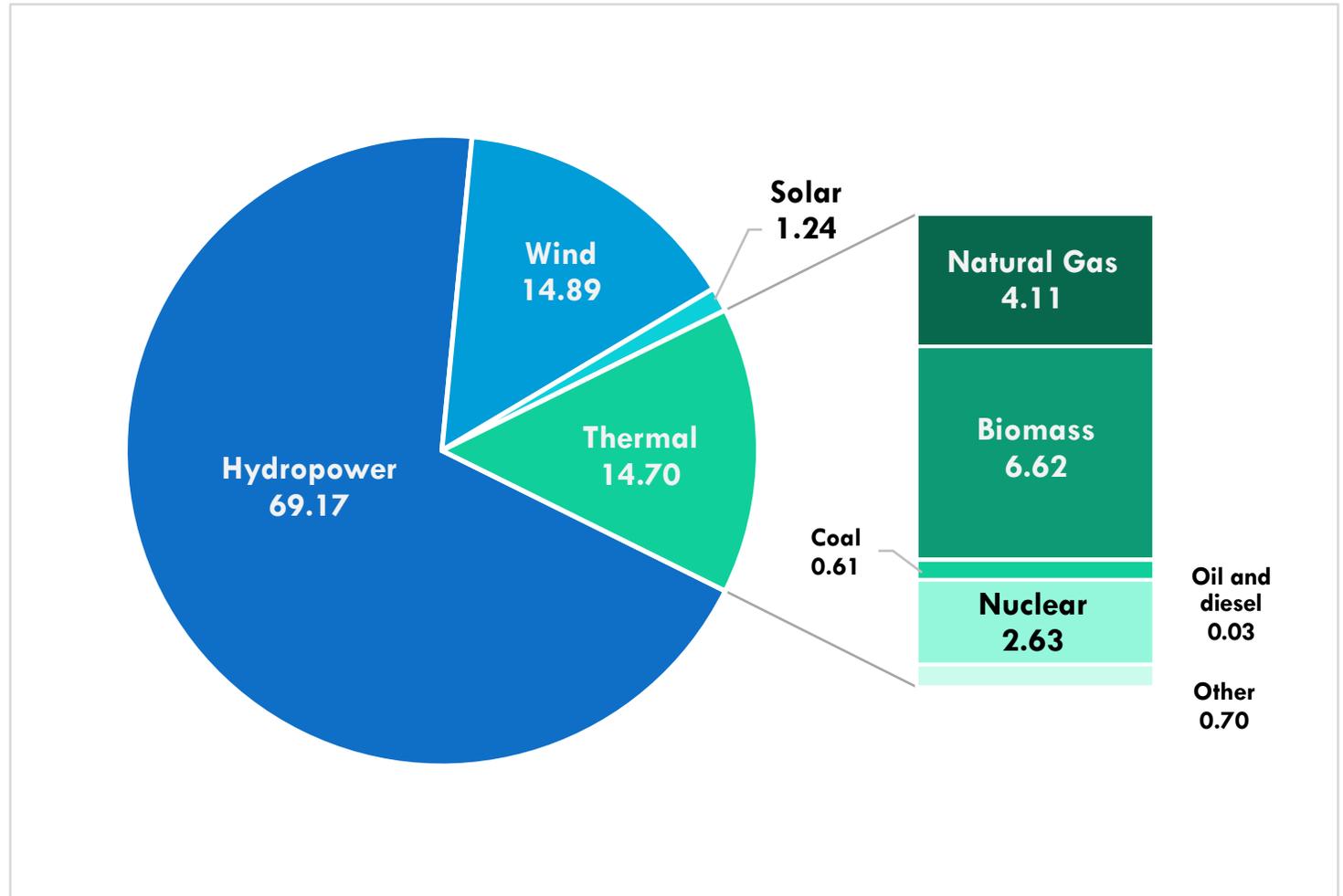
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Overview

- **Brazil**
 - Population: 210 million (2019)
 - Area: 8.5 million km²
 - GDP: US\$ 1.868 trillion (2019) - IMF
 - GDP per capita: \$ 8,717 (2019) down from \$9,000 in (2018)
- **Brazilian Power System**
 - Predominantly Hydro participation
 - Vast Transmission Grid
 - Universal Access to Electricity

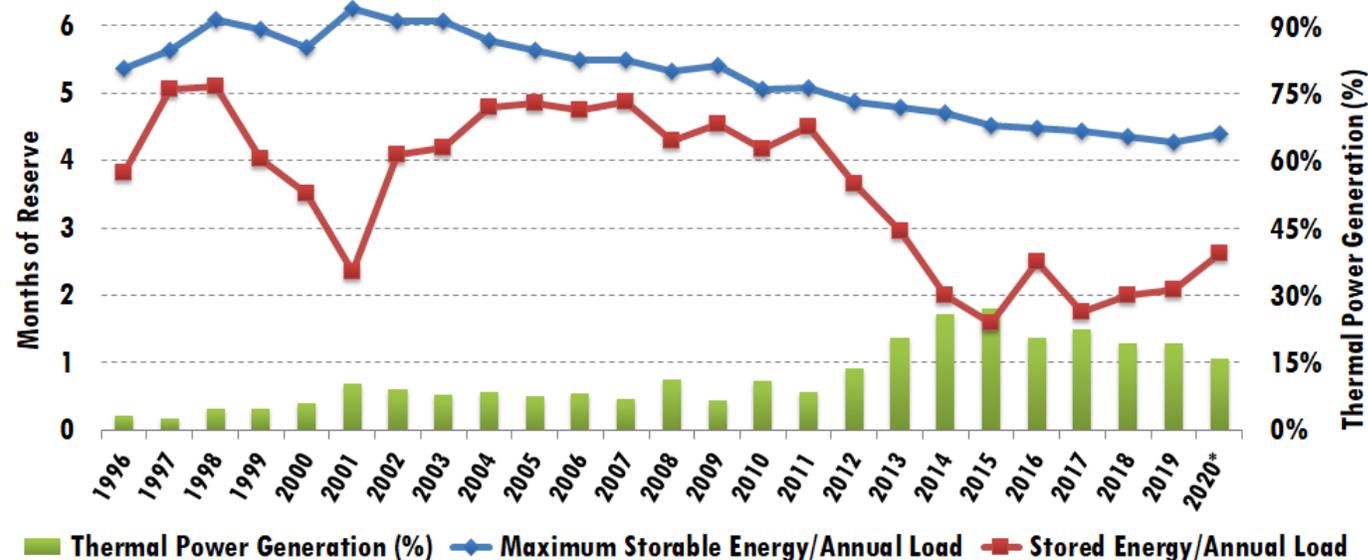
Total Installed Capacity in the Power System (2020)



Gradual loss in regularization of storage capacity in reservoirs

- Lower regularization of reservoirs' capacity implies smaller ratio between amount of energy stored (reserves) and annual demand (no. of months).
- The lower ratio indicates the need for adding other generating sources.
- The hydropower platform is not fully used and optimized due to lack of incentives.

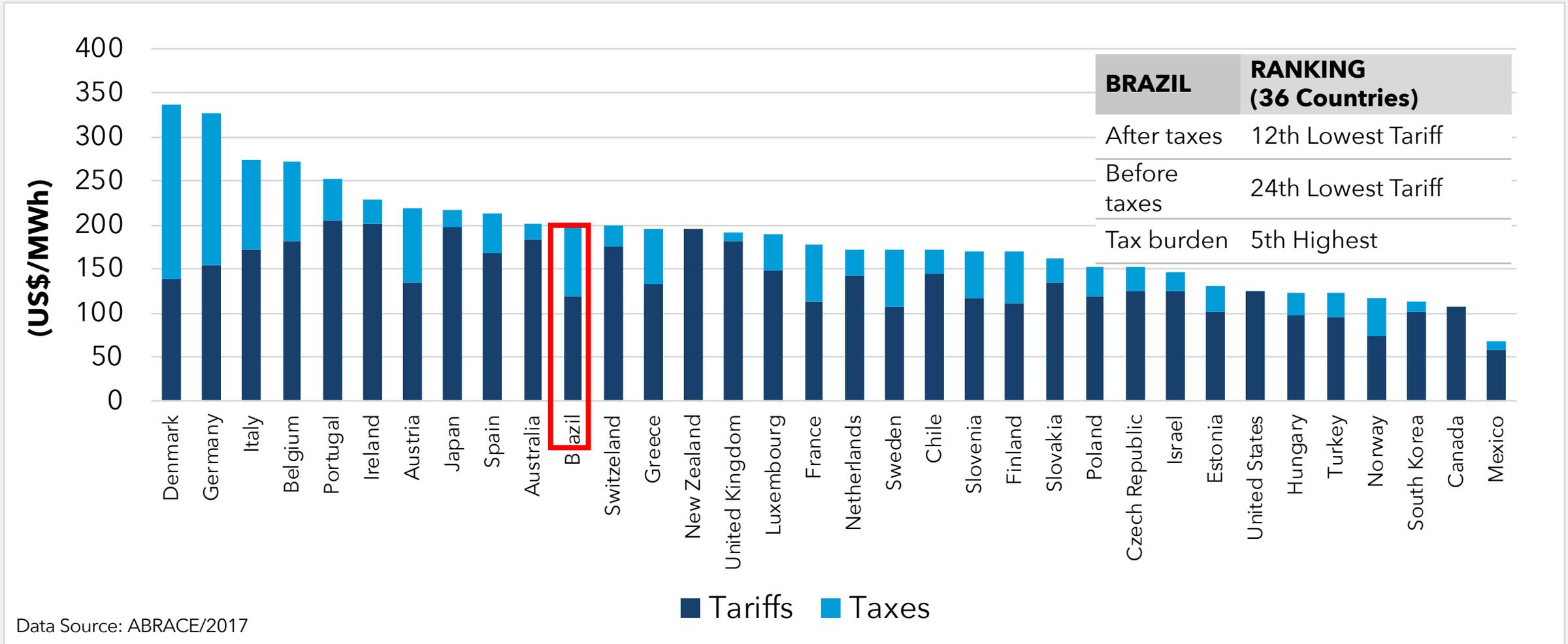
Loss in regulation capacity in hydro reservoirs in Brazil



Source: Own elaboration based on ONS data

Electricity Tariffs for Residential Customers 2017

European prices in a middle-income country



Restructuring Project for Brazil's Power Sector

The Inception: Project RESEB 1996-1998

The RESEB Project (Coopers&Librand) presented two possible approaches to electricity prices formation (Working Paper A1):

Option 1: System dispatch based on technical plant data only. (...) There would be central determination of water values and of Wholesale Energy Market prices

Option 2: System dispatch based on water values determined by generators themselves, involving a considerable degree of generator self dispatch.

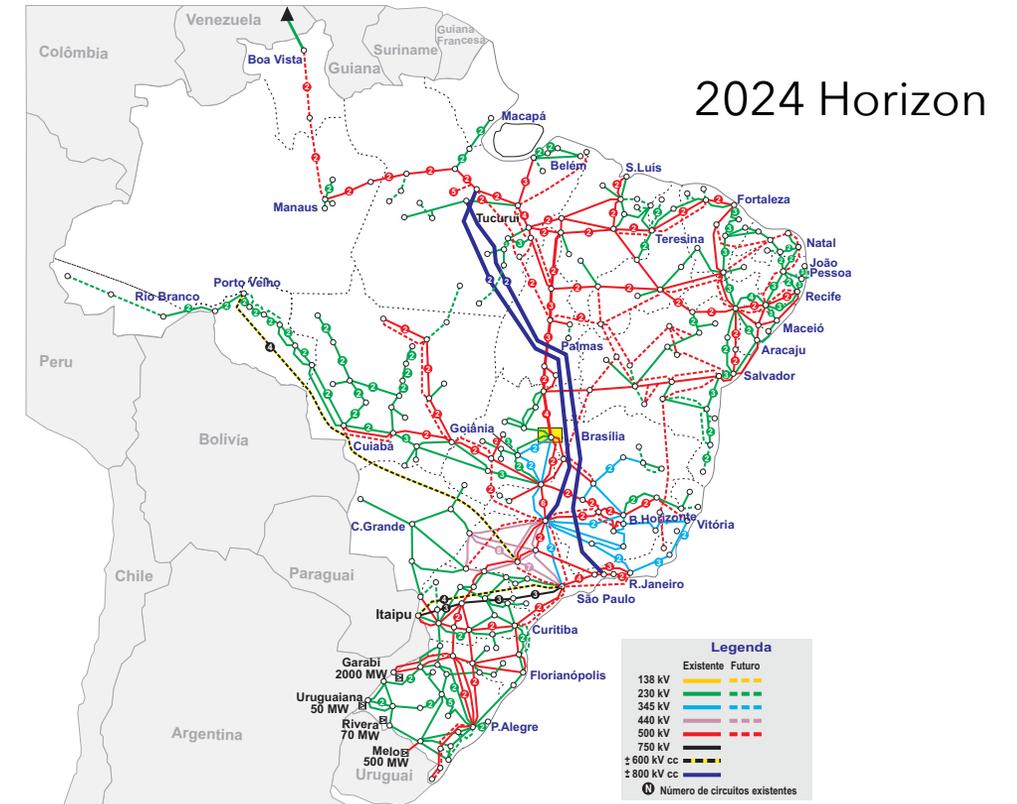
The Wholesale Energy Market price would be calculated on the basis of bid data.

Option 1 was chosen!



National Grid

- Adopted the ISO Model – separated from the Market Operator
- Centralized grid planning
 - BOOT auctions have attracted investments
- TRANSCOs' compensation based on guaranteed revenues linked to availability
- Zonal pricing (four zones)
 - MC calculated in approximately 7,000 nodes



Source: ONS (www.ons.org.br)

Markets & Risks Allocation

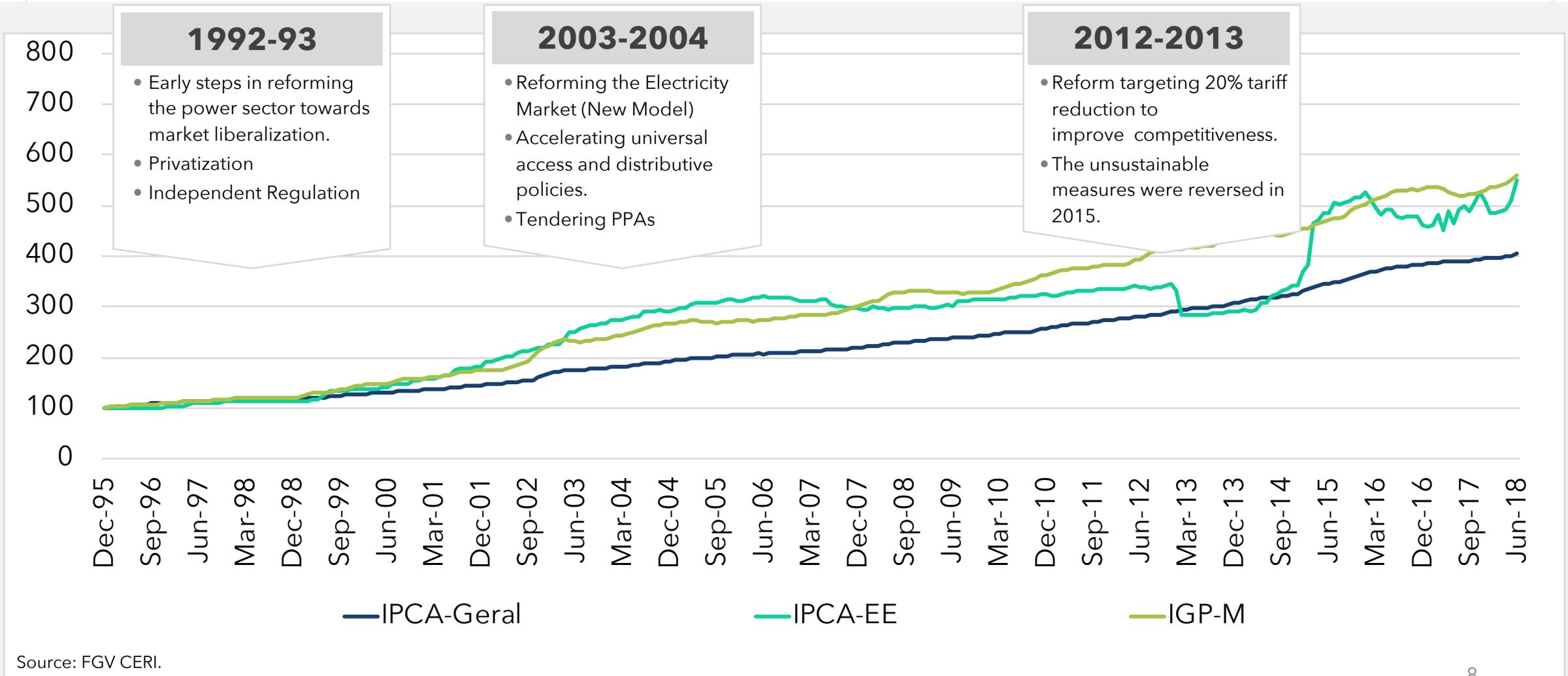
Markets

- Two Contracting Environment with competitive doors:
 - Competition for the market based on long-term PPAs auctions (20-30yrs tenor indexed by inflation, some technology specific) - not a single buyer
 - Competition in the market - Large C&I consumers can contract in the Free Contracting Environment
- Cost-based dispatch with differences settled at PLD value (Spot "price")
- Distribution (wires and energy bundled)
 - High-powered incentive regulation to set tariffs - energy costs passed-through to consumers.
 - Highly distortionary cross-subsidies - virtual net-metering included.

Risks

- Risks borne by the end-user in a highly centralized contracting environment
- MRE: risk sharing mechanism among hydro power producers to tackle externalities from GenCos in the same cascade
 - Dysfunctional today due to climate variability affecting river flows

Two Decades of Electricity Reforms in Brazil



2020 Diagnostics: Market design not robust enough to address changes in critical underlying conditions

- Change in rivers inflow patterns due to climate variability magnified impacts from distortions associated with the MRE.
- Cost-based dispatch and pricing (PLD) are unable to reflect opportunity costs
- Regulatory interventions (price caps).
- Lack of retail competition and regulatory compliance means captive consumers do not observe prices that reflect opportunity costs.
- Inefficient and burdensome incentives and taxation regime.

Main Challenges & Emerging Trends

- Resilience to climatic variations:
 - Historical or past rain conditions may not be representative of future conditions .
 - Current dispatch solution relies on historical distribution of hydro conditions, not a forward curve to include climate variability.
- Increasing participation of VRE in the generation mix.
- New wave of liberalization pulled by consumers.
- The Gas Market Reform: attempt to implement a competitive gas market.

The 2018-20 Proposed Power Sector Reform: Conflicting intentions

- Addressing Resource Adequacy through **centralized contracting of capacity**
 - New and stronger **liberalization** trends undermine the ability of existing contracting mechanisms to ensure system expansion.
 - Proper design and implementation of energy and ancillary services markets are not at the center of discussions (or periphery).
- Phasing-out cross-subsidies to renewables.
- Privatization of Eletrobras through capital increase.

The Fork on the Road Ahead

- Markets as drivers of investment decisions
 - Bid-Based Dispatch - LMP?
 - Markets for energy, ancillary services, demand response, other dimensions (including dispatchability)
- Wave of liberalization and impacts on financiability
 - Sustainable and resilient investments & operations

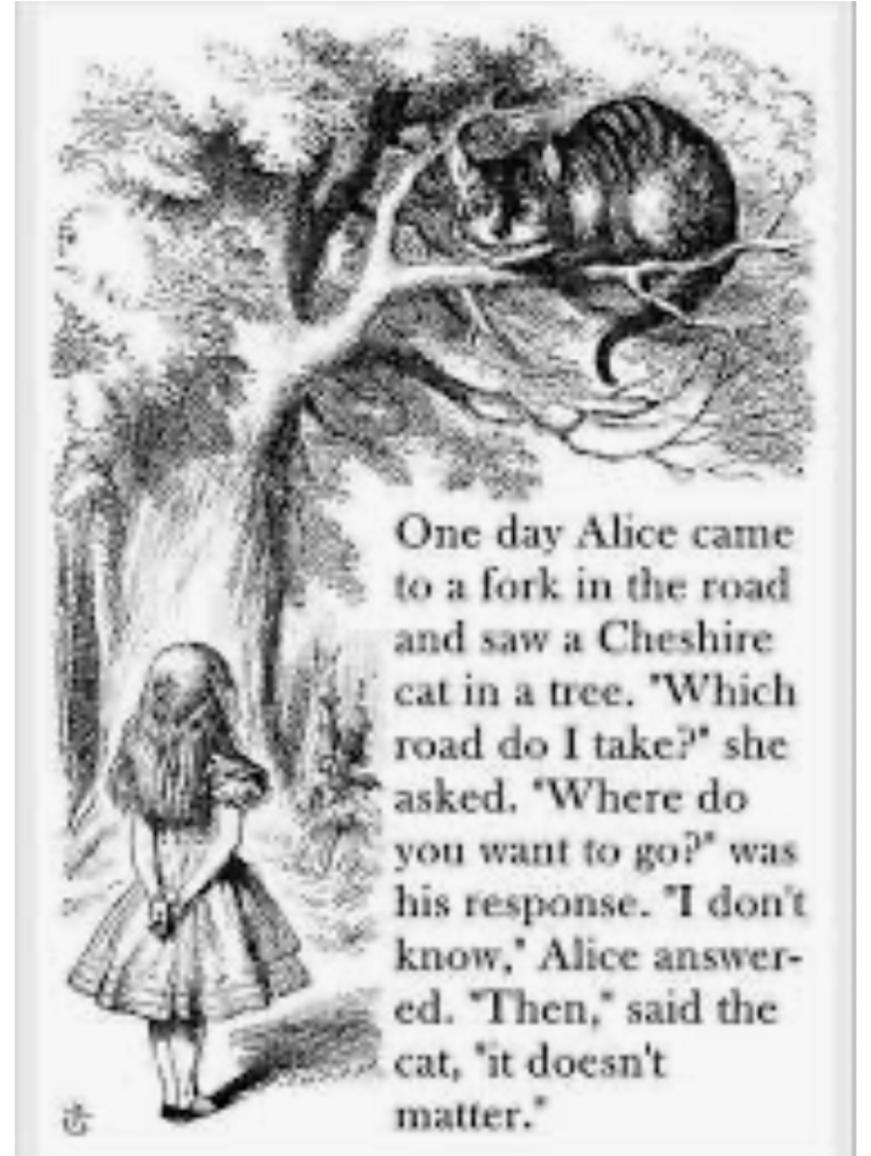




Concluding Remarks

- The current market design is not robust enough to address changes in the underlying conditions at inception.
- Predominantly renewable power system in need to detach itself from highly centralized contracting environment.
 - New approach (RA management) based on old solutions (centralized capacity contracting) leads to known results
 - Proper design and implementation of energy and ancillary services markets is not part of the discussion.
- The recent transitory proposal allowing for capacity (reserve) auctions could become perennial.

Moment of Truth



One day Alice came to a fork in the road and saw a Cheshire cat in a tree. "Which road do I take?" she asked. "Where do you want to go?" was his response. "I don't know," Alice answered. "Then," said the cat, "it doesn't matter."



Thank You!

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