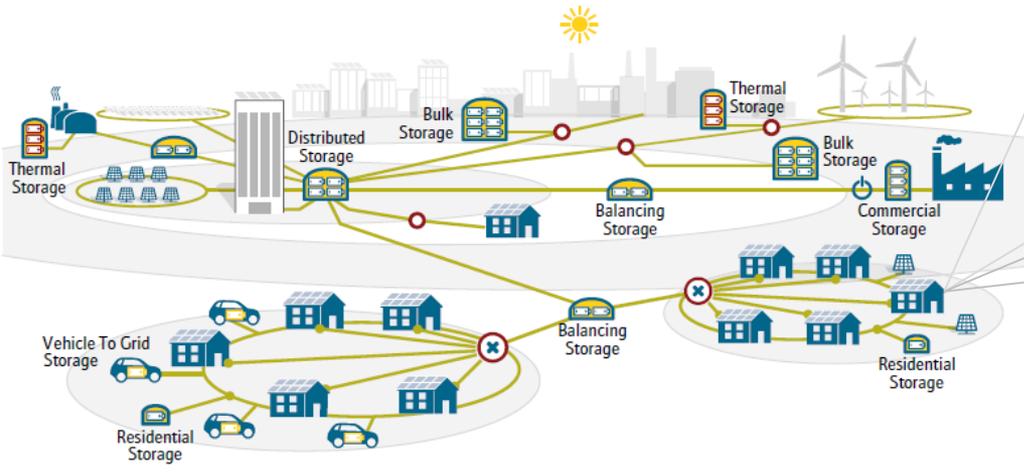


The Brazilian Power Sector Reform

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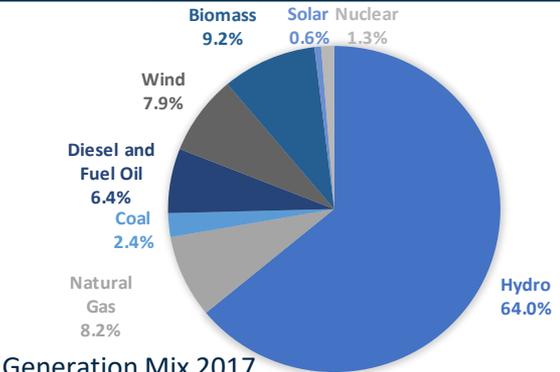


Brazilian Power Sector Overview

Brazilian Power Sector at a Glance

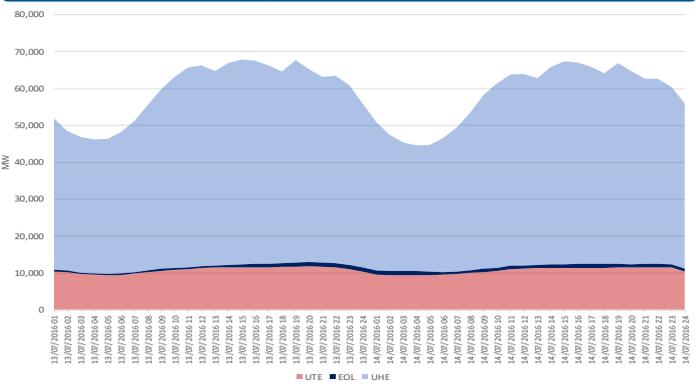


Hydro Dominated

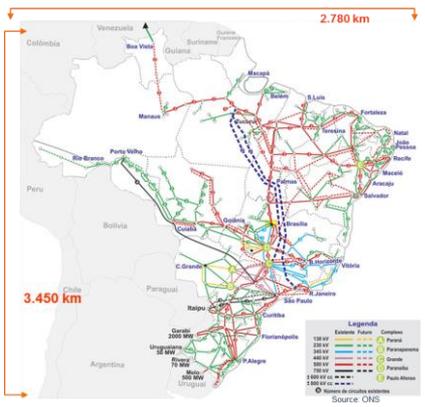


Generation Mix 2017

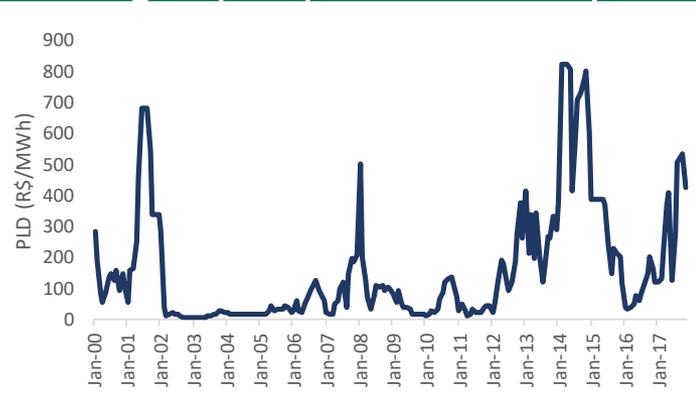
Energy constrained



Transmission lover



High spot price volatility



Brazilian Power Sector Overview

Regulatory framework summary



100% contract obligation

- Expansion based on auctions for the regulated market

Simplified auctions

- Contracts only for energy
- Other services are not contracted (ancillary services, flexibility, capacity, etc)

Centralized cost-based dispatch

- Risk aversion of the market set by the government

Risk allocation

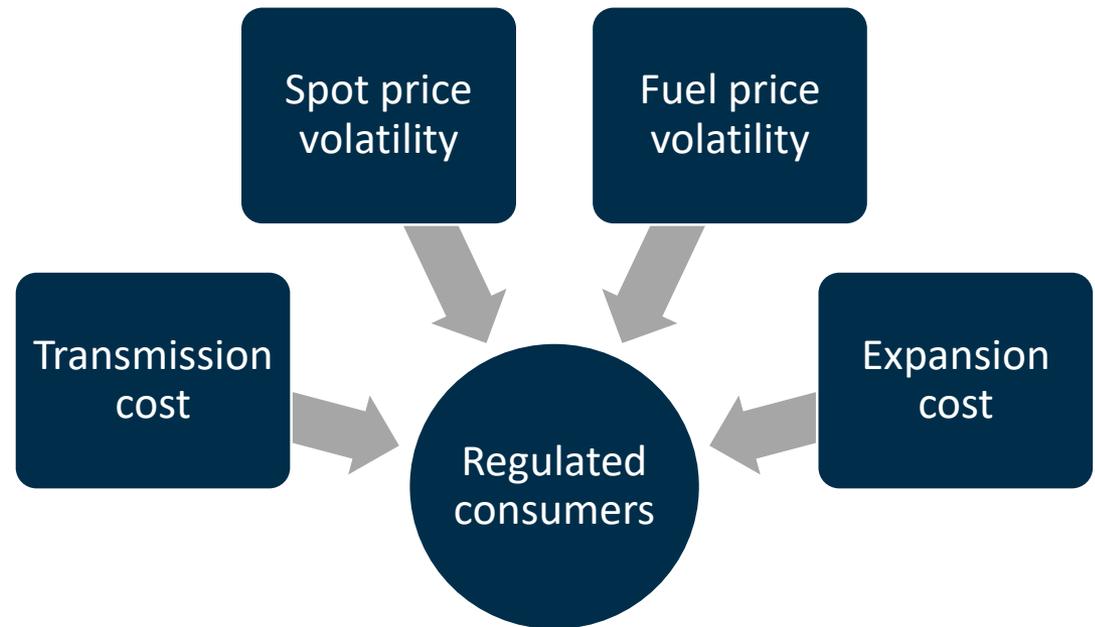
- Hydro plants face market risk
- Thermal and renewable market risk passed through the regulated consumers

Brazilian Power Sector Current Situation

Current market design is not sustainable



- Risk allocation centered on the regulated consumers;
- Pressure for market liberalization;
- Inefficient incentives for renewables;
- Increase of free consumers and prosumers;
- Higher need for ancillary services (hydro capacity reduction and increase of intermittent generation)



Brazilian Power Sector Perspectives

Power market reform



Improvement on the price signals

- Hourly prices
- Day ahead market with price bids
- No volumetric tariffs
- Locational signals
- Market risk allocated to generators
- Ancillary service market

Clean energy certificate market

- Changing the mechanism to foster renewables

Unbundle security of supply and energy contracts

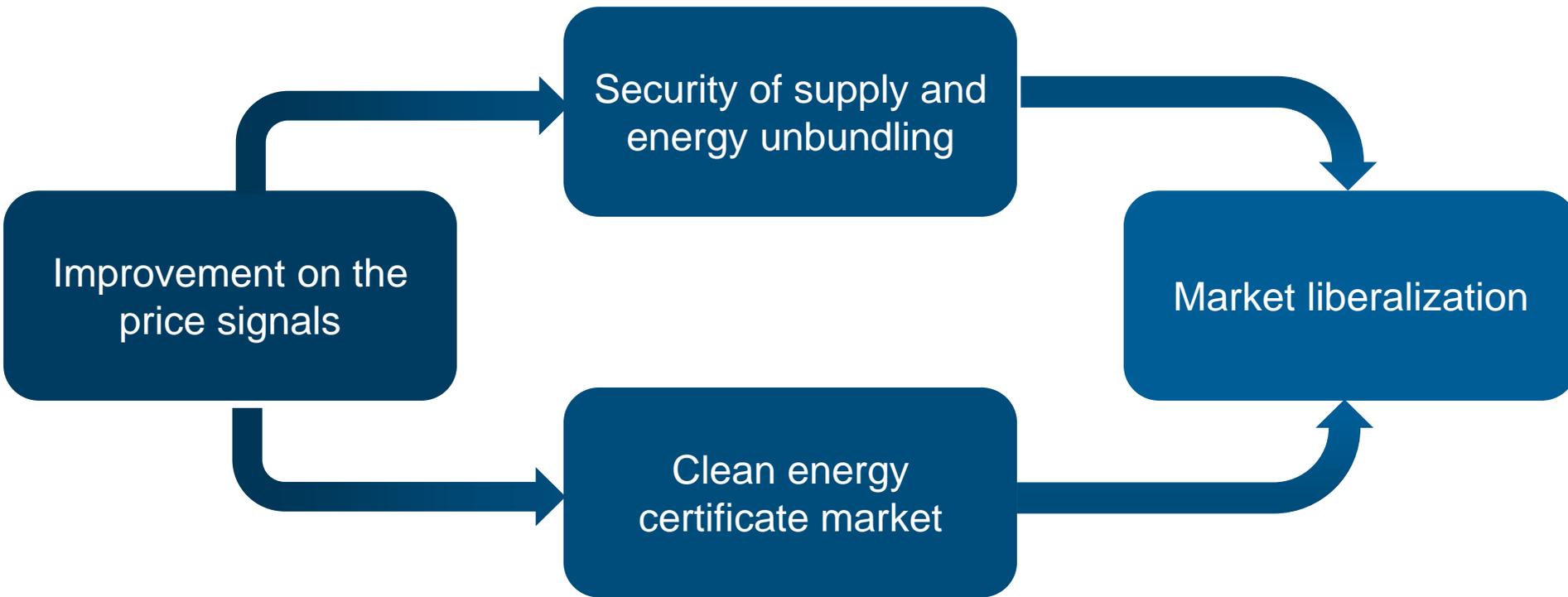
- System-wide capacity (and energy) payment mechanism
- Improvement on financing
- Better allocation of the expansion cost

Market liberalization

- > 0.3 MW fully free after 2024

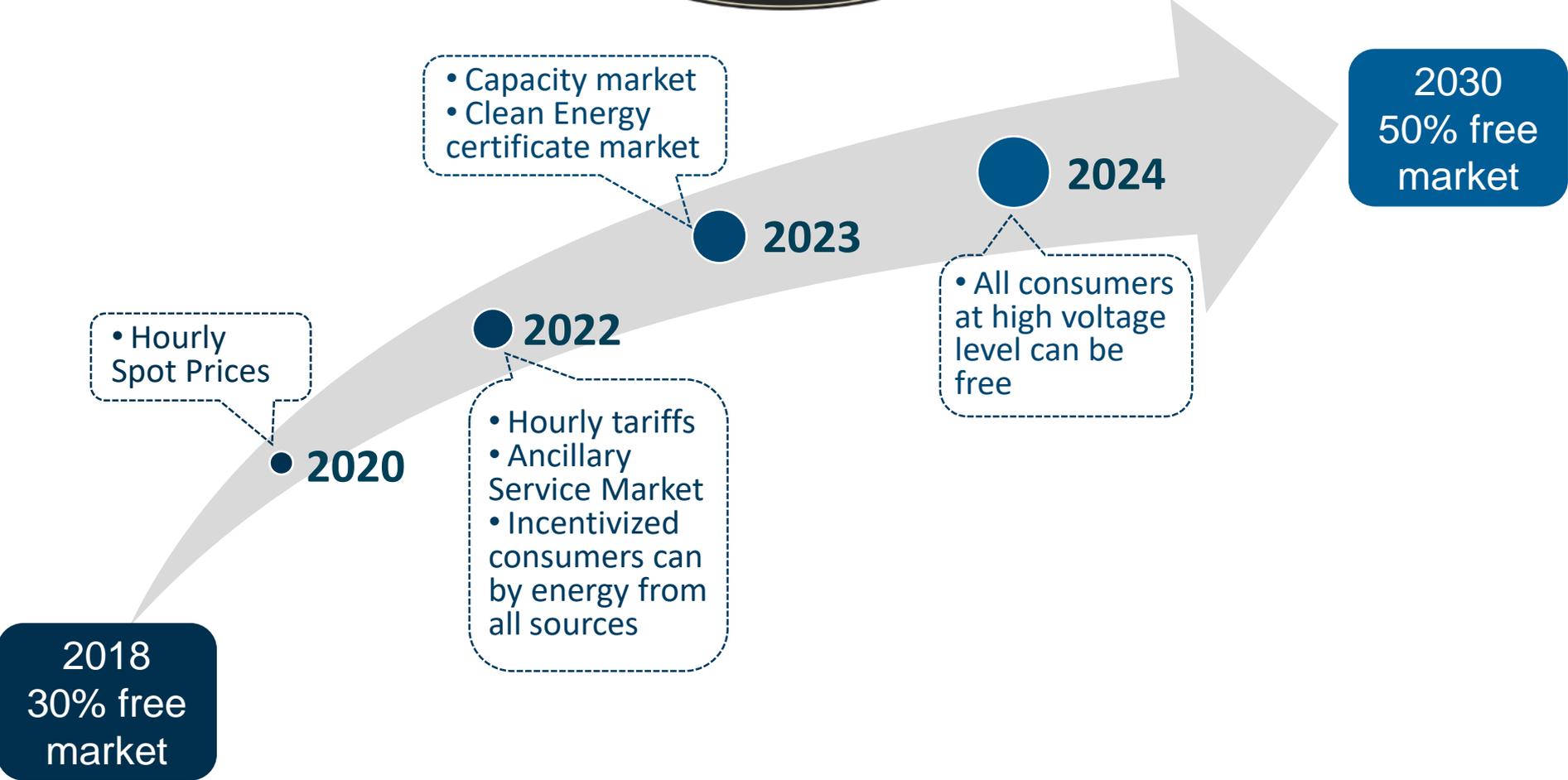
Brazilian Power Sector Perspectives

Sequence (preconditions)



Brazilian Power Sector Perspectives

Timeline of changes (PSR's view)



Brazilian Power Sector Perspectives

Conclusions



- The original challenge for Brazil was to implement "competition for the market".
 - Due to the lack of credibility, the auctions were made in a simplified way using only 1 attribute (energy) of the power plants and bundling security of supply and energy in the same contract.
- Auctions were a success and in particular revealed the potential of biomass, wind and solar, being a reference for the rest of the world.
 - Problem: more complex electrical matrix and excessive allocation of risk to the regulated consumer
- Current challenges: sustainability for opening the market and preparing the model for the prosumer
- The modernization of the electric sector brings several challenges for the modeling of electrical systems



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