

THIS IS A PLACEHOLDER DECK

Brazil Power Market Key Trends and Challenges

New Market Service



Aurora provides market leading forecasts & data-driven intelligence for the global energy transition

A U R  R A

Power markets



Renewables



Storage



Electric vehicles



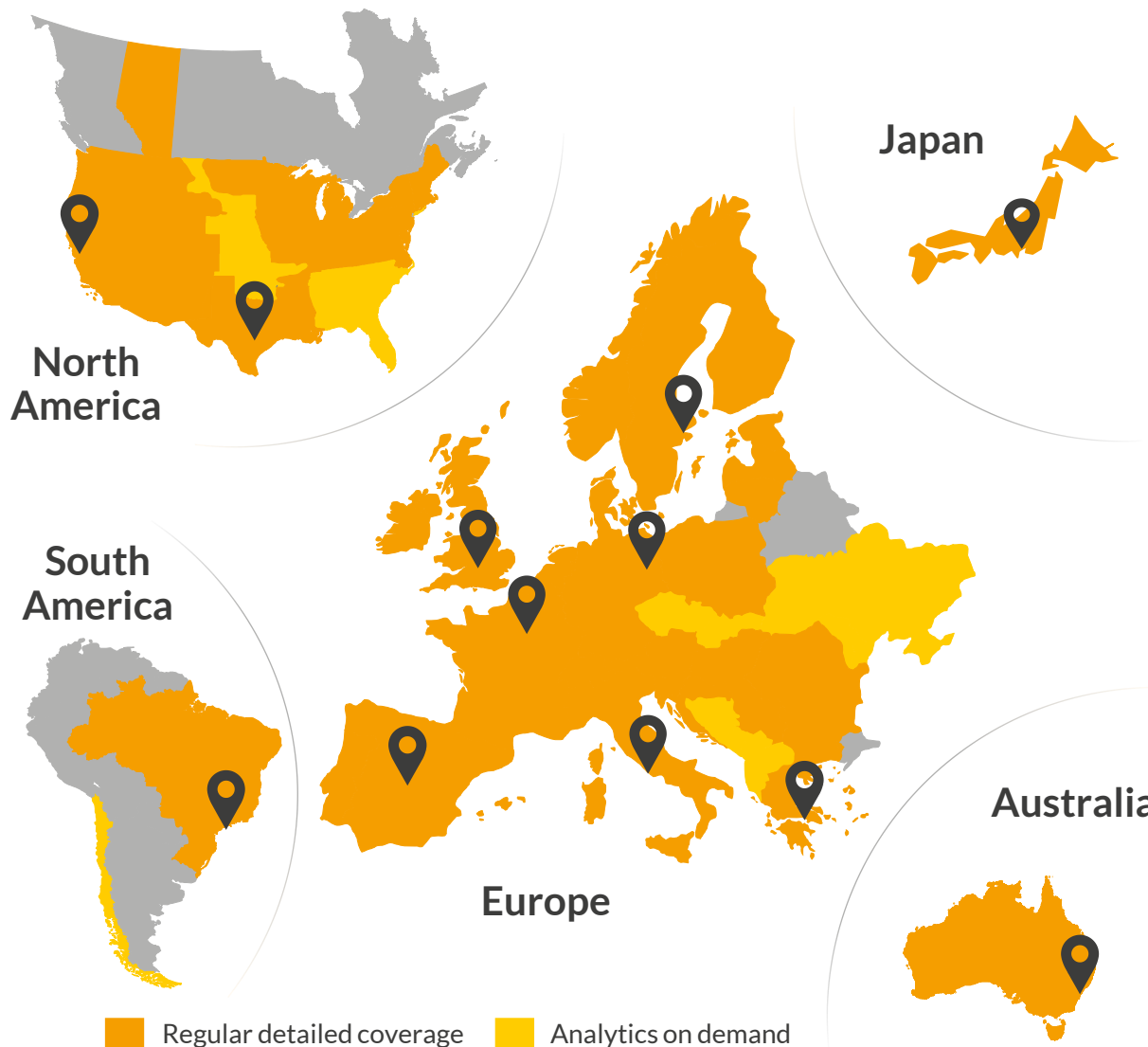
Hydrogen



Carbon



Natural gas



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500+

market experts



750+

subscribing companies










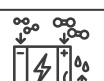

150+

transactions supported in 2022



Brazilian market players have raised a lot of concerns about the future of power, and we identified the biggest painpoints

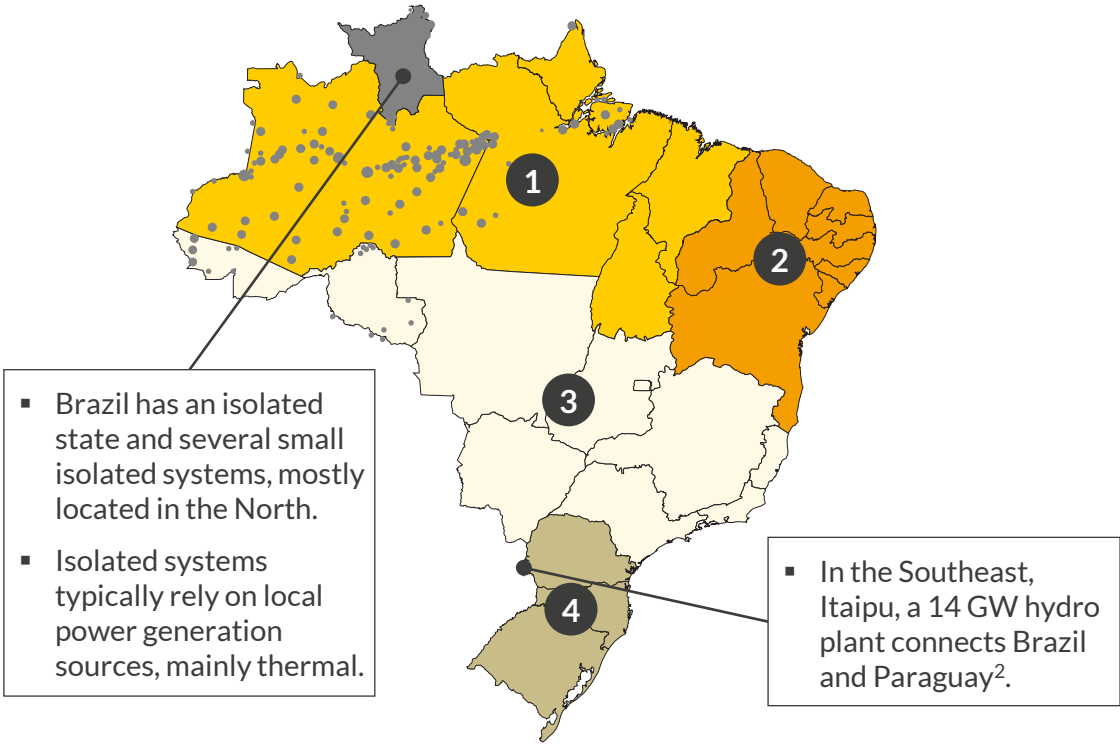
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 Hydrology	How will different weather years and climate change impact power prices and asset economics?
 Liberalisation	How will the speed of market liberalisation affect risks and opportunities for new asset development?
 Energy demand	Current demand is lower than expected. Will energy demand rebound? What is the impact of lower demand on suppliers in the regulated market?
 Distributed generation	What will be the impact of the continued growth of distributed solar on electricity demand and the need for new centralised assets?
 Grid constraints	What if the transmission grid is not expanded as needed? Where do we expect to see emerging congestion issues and what would be the impact on asset economics?
 Messy transition	Will supply chain challenges slow down new build generation?
 Flexible generation	What is the role of distributed and centralised flexible generation in the Brazilian power market? Will the market have room for storage given the high share of hydro flexibility?
 Green hydrogen	What is the internal Brazilian demand? Can we export to European and other markets? What will be the impact on the Brazilian power market?
 Market advisors	Are the current forecast providers sufficiently independent?

The Brazilian interconnected power system supplies over 99% of the country’s demand and is divided in four submarkets




The Brazilian interconnected power system¹ supplies over 99% of the country’s electricity demand. Although Boa Vista (Roraima) is the only state capital that is not connected, there are still 212 isolated systems across seven states. Brazil’s most relevant international interconnection is with Paraguay via a 14 GW binational hydro plant².

Map of the Brazilian interconnected power system³



Market snapshot by 2022

Regions	Installed capacity GW	Share %	Annual demand TWh	Share %
1 North	27	15%	54	9%
2 Northeast	45	25%	98	16%
3 Southeast	86	47%	348	57%
4 South	24	13%	103	17%
Isolated systems	1.2	1%	3.9	1%

 North  Northeast  Southeast  South  Isolated systems

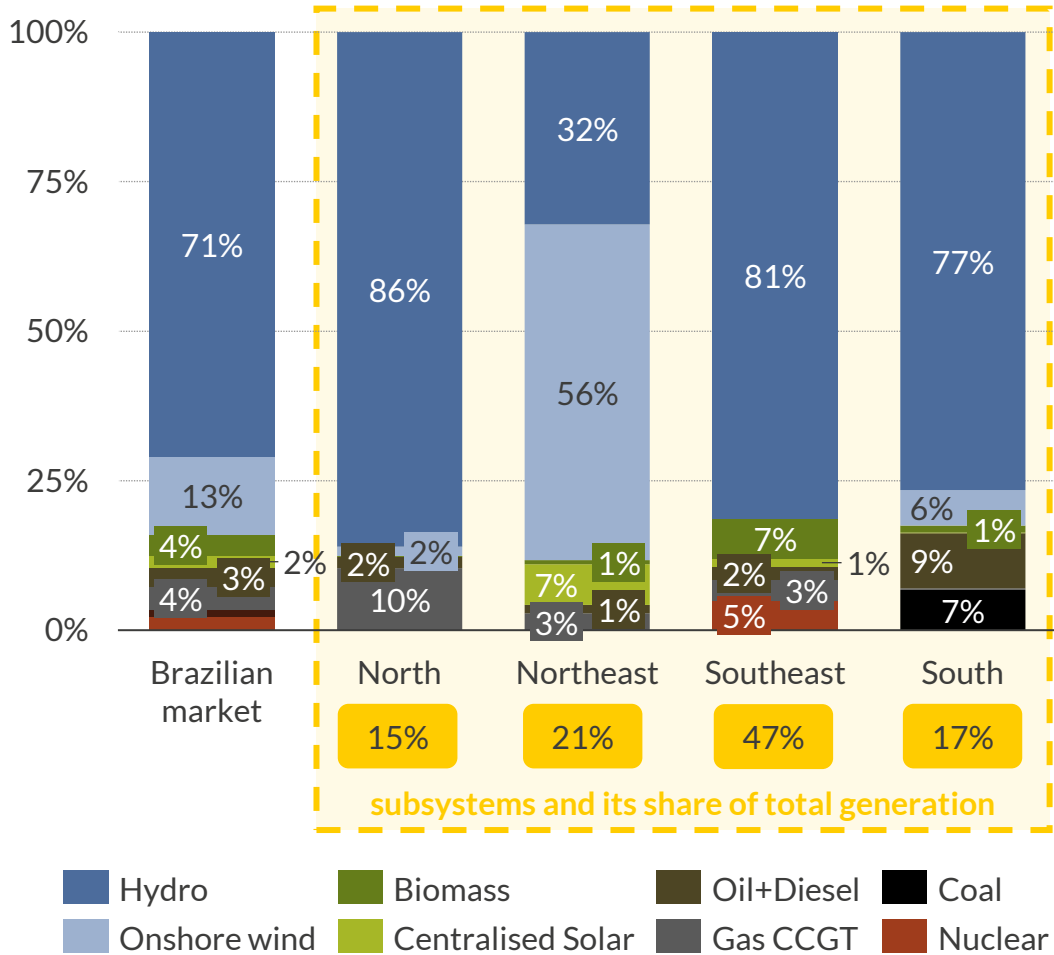
1) “Sistema Interligado Nacional”, or SIN. 2) Brazil is also interconnected with Argentina and Uruguay via 2.2 GW and 0.57 GW of transmission lines, respectively. Brazil operates at 60 Hz and Paraguay, Argentina and Uruguay at 50 Hz thus converters are required. There is also an interconnection with Venezuela and the Roraima grid, which is not part of the interconnected power system. 3) Grey areas are not connected to the power system.
Sources: Aurora Energy Research, ONS, EPE, ANEEL

Hydro dominates the market's generation mix; dispatch of the system revolves around optimising short and long-term hydro opportunity costs

Key features of the Brazilian power market

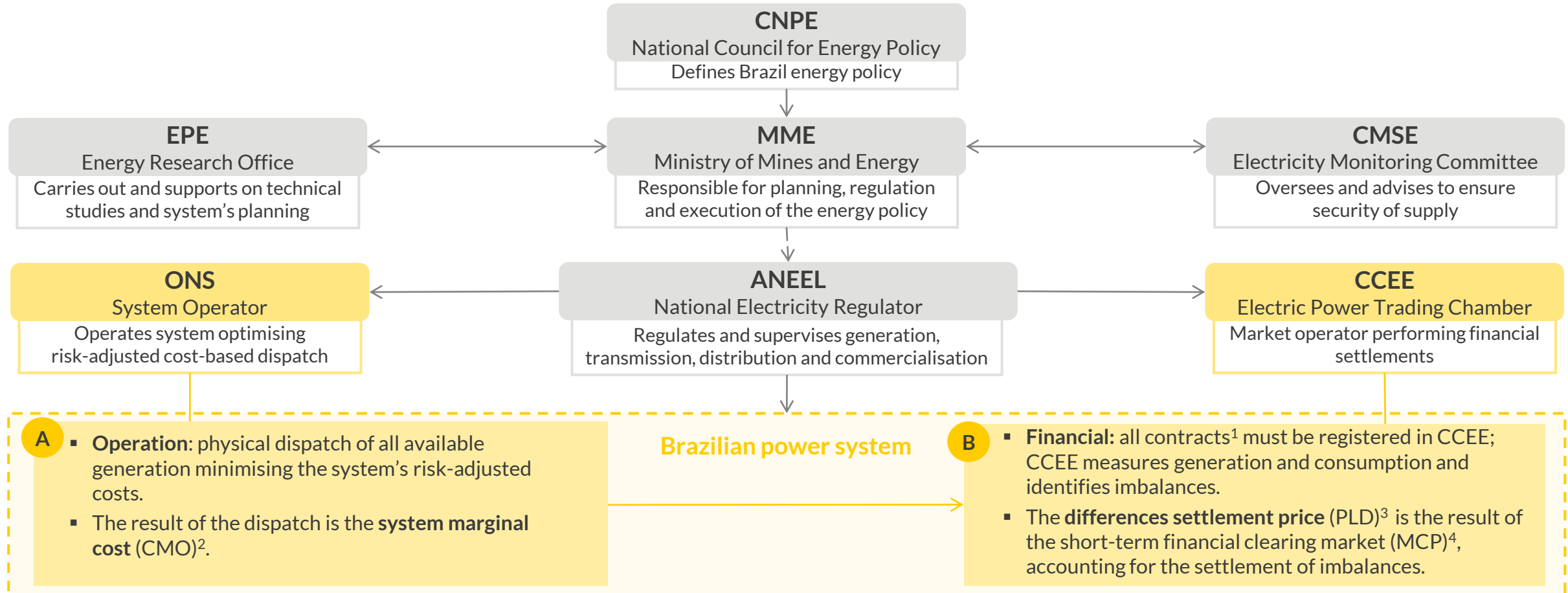
- 1 Hydro dominated market, representing 63-77% of the generation mix over the last 10-years**
 - ONS optimises hydro operations based on water values¹ over five years. The system operation is updated on a rolling-horizon resulting in day-ahead hourly prices.
 - Hydro is the fundamental driver for low or high power market prices, depending on abundant or scarce water periods.
- 2 Split into four subsystems with different hydrological conditions and renewable resources**
 - The Southeast/Midwest represented 47% of the total generation by 2022, mostly hydro. Given Brazil's large territory, there are hydrological differences across subsystems.
 - When operating the market, plants are treated as a common pool exploiting the subsystems' complementarity; but there is also a central hedging approach that shares hydrological risks evenly among individual plants².
- 3 Energy-only day-ahead market with a capacity reserve**
 - ONS controls day-ahead and real-time dispatch. The current market design still relies heavily on auctions and long-term contracts³.
 - There are no balancing or reserve markets, but there are availability auctions, ensuring plants are available. Dispatch is done on a merit order basis, unless out of merit operations are required to enhance reliability and security of supply.

Technology share in the generation mix by 2022: market and subsystems



The federal government is responsible for the energy sector and is supported by key institutions shaping its regulatory and policy framework

The Brazilian power system operation is centralised and cost-based. The System Operator (ONS) is responsible for the programming and dispatch of available resources to minimise the power system's total risk-adjusted costs, while the Electric Power Trading Chamber (CCEE) performs all financial settlements.

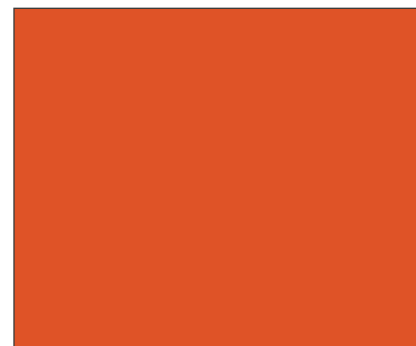


Legend: Institution Operator X Deep-dive in our first Brazilian Power Market Forecast

1) All contracts from both regulated contracting environment ("Ambiente de Contratação Regulada" or "ACR") and from free contracting environment ("Ambiente de Contratação Livre" or ACL). 2) "Custo marginal de operação". 3) "Preço de liquidação das diferenças". 4) "Mercado de curto prazo"

Brazilian Reduced Power & Renewables Market Service:

Dive into key market analysis and forecasts for the Brazilian power and renewables markets



Power & Renewables Forecasts

Forecast Reports & Data



Biannual forecast reports with quarterly data updates

- Forecasts of wholesale market prices until 2060
- Data under **four scenarios: Central, High, Low**, as well as an additional **Net Zero**
- **Quarterly updates** to reflect near term commodity price changes
- All the latest trends, forecasts, and recent market and policy developments
- **Price distributions**, capture spark spreads, and peak prices
- **Capacity development**, generation mix, interconnector capacity, capacity buildout, and exports
- **Capture prices** of key technologies (onshore, solar), load factors
- **EU ETS carbon price** & gas price forecasts
- All forecast data easily downloadable in Excel format and available as interactive dashboards on our EOS platform

Strategic Insights



3 Strategic Insight Reports

Three in-depth thematic reports on topical issues



Policy Updates

Timely research notes on recent changes to policy and regulation, demonstrating the impacts and opportunities for market participants



3 Group Meetings

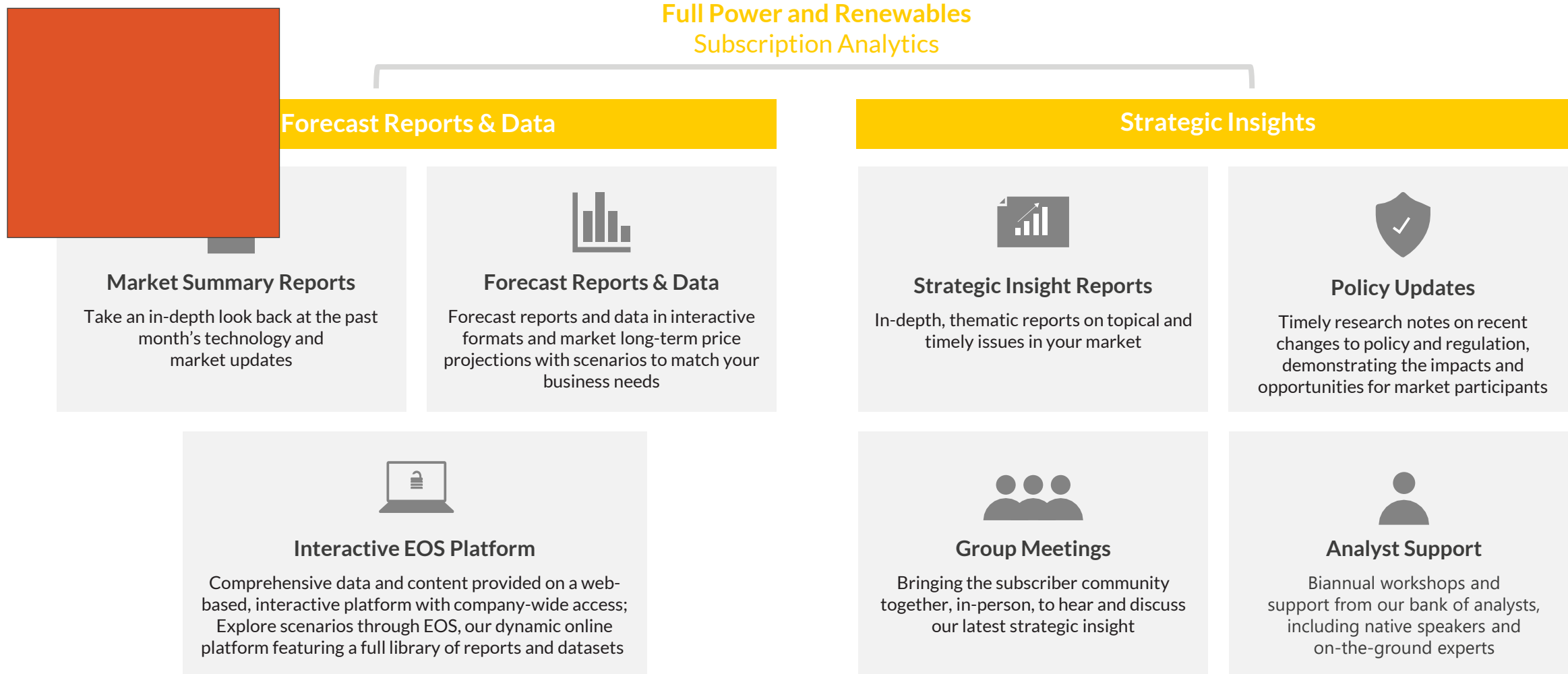
Three Group Meeting roundtable events with key market participants such as developers, investors, financiers, utilities, grid operators, government



Analyst Support

Biannual workshops and support from our bank of analysts, including native speakers and on-the-ground experts

The Brazil service will include all components of our **power and renewables** markets subscription services in Europe and the USA



Join key players from across the Brazilian power sector

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We work with a very broad range of clients ... their constant challenge keeps us up on our toes and ensures our independence



"With its capabilities, intellect and with its credibility Aurora plays an essential role bringing the dialogue [in the global energy transition] to a different plane"

Ben van Beurden, CEO, Shell



"Aurora analysis and the provision of reliance was crucial for our debt funding. Their ability to explain market logics and revenue streams was vital for this successful financing."

Jeremy Taylor, Director, Green Frog Power



Power & utilities



Oil & gas



Energy consumers



Project developers



Financial sector & investors



Policy & regulation



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