



Resilience in South America Brazil and Colombia experience

03/2016



“El Niño”

- El Niño is an abnormal weather pattern caused by the warming of the Pacific Ocean near the Equator, off the coast of South America
- It reaches its highest point at the end of the year (December) but its effects are felt throughout the northern hemisphere spring (March-May) and can last up to 12 months
- High temperatures, low rainfall with drought and abundant rainfall associated with floods
- The current “El Niño” intensity is considered the worst in recorded history (1982-83 y 1998-99)



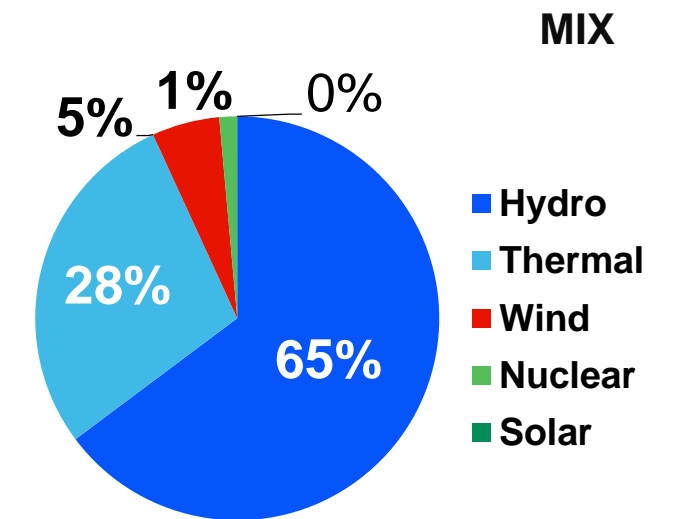
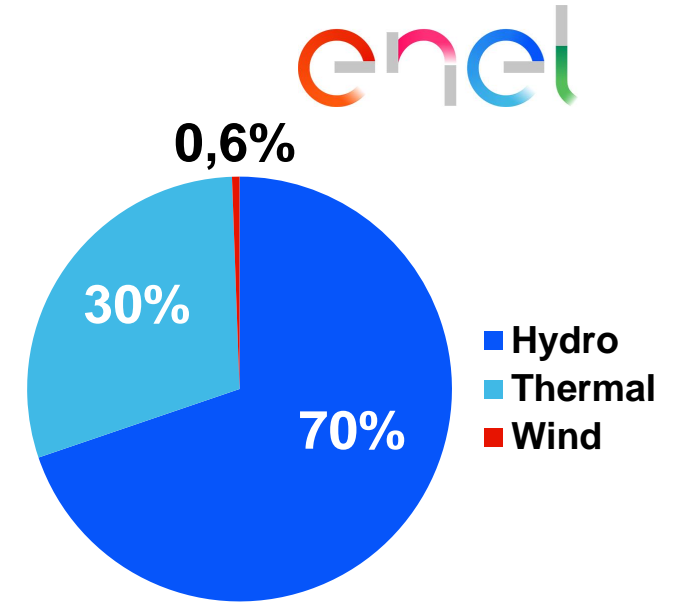
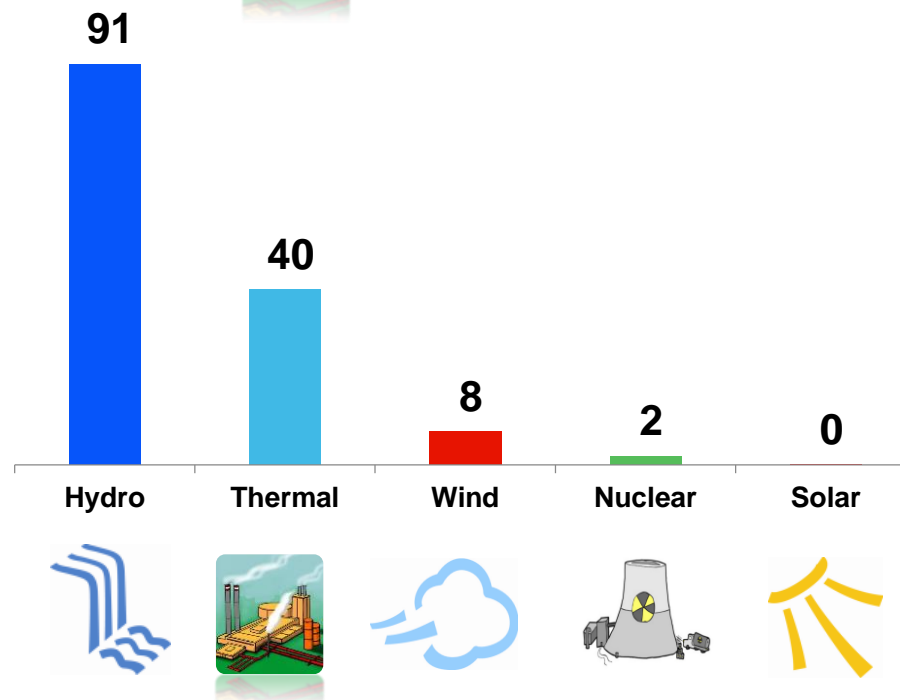
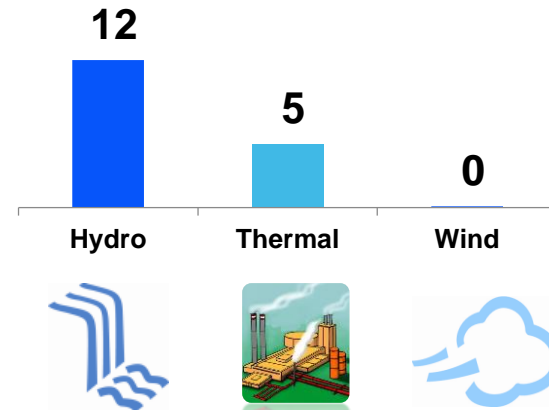
Installed capacity



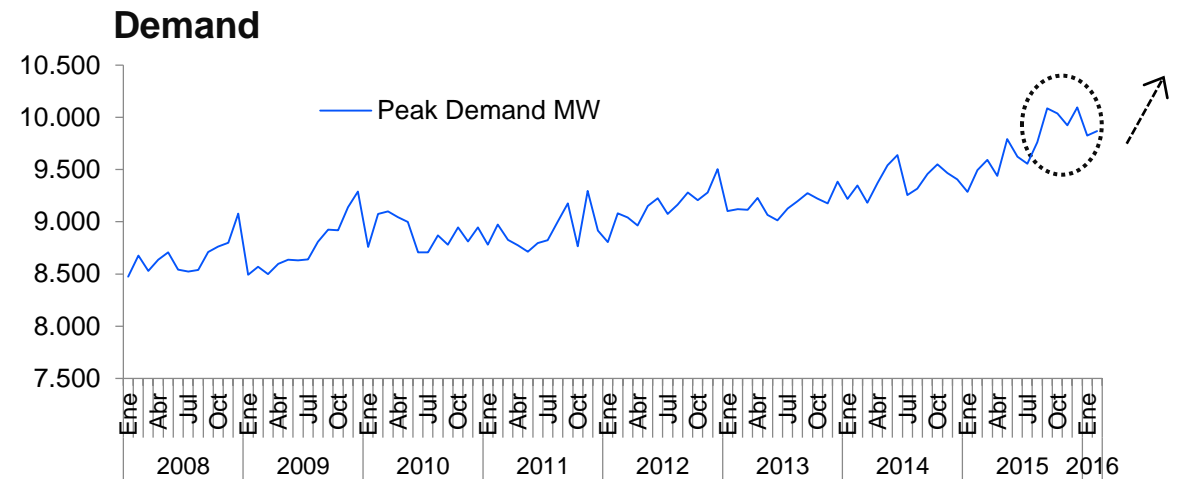
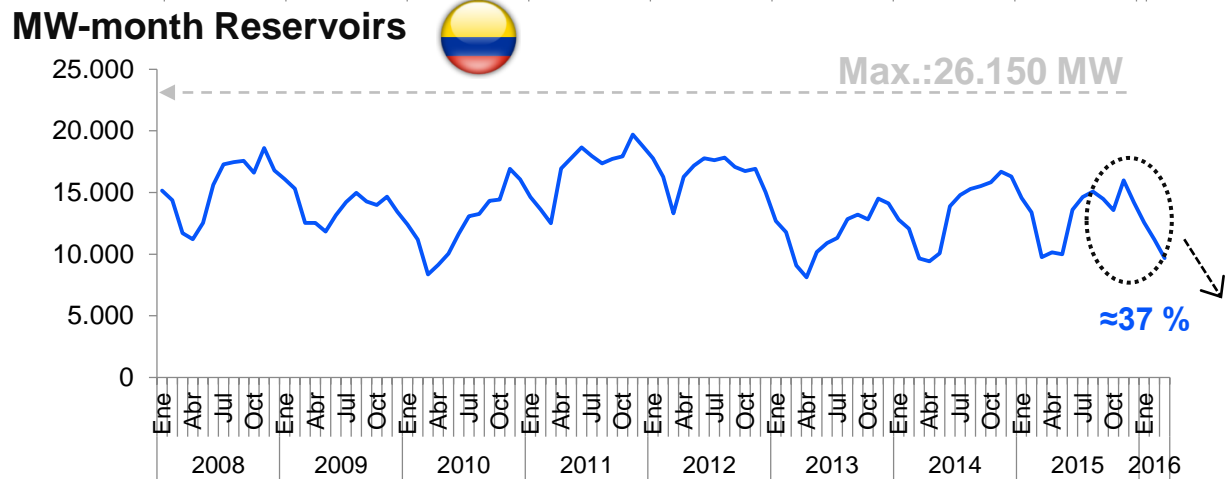
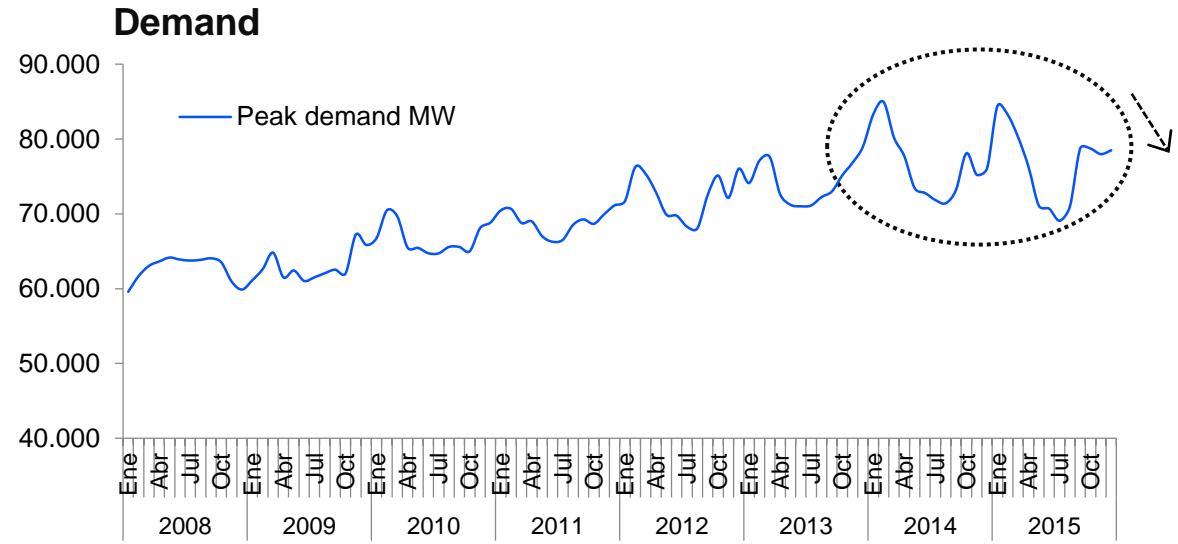
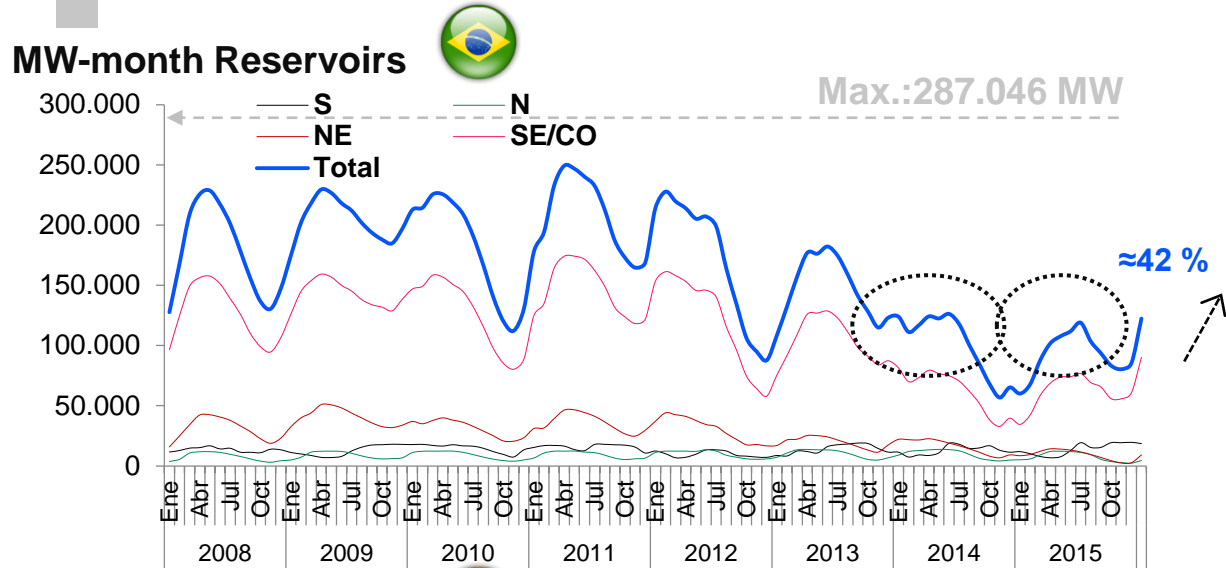
Installed capacity
16,5GW
(7%)

Installed capacity
141 GW
(61%)

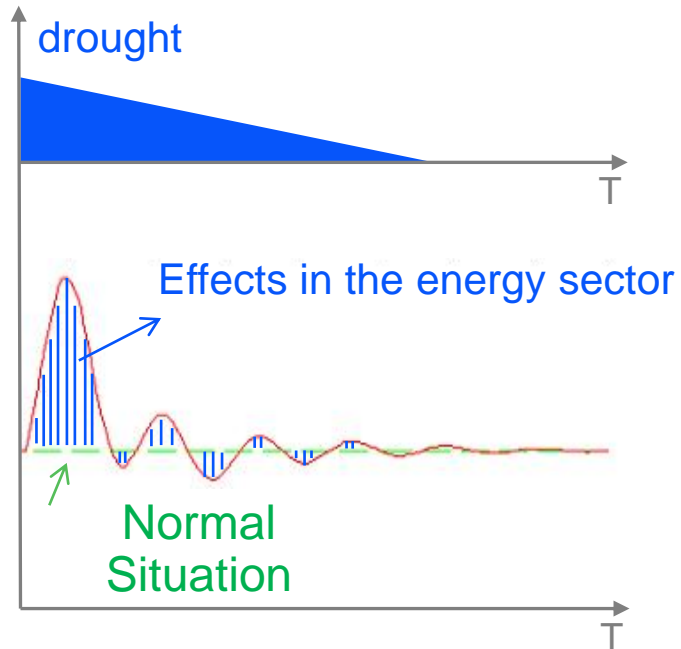
Installed capacity
≈ 230 GW



Electric sector situation



The Electricity Generation System Resilience



- Thermal generation dispatch to avoid using hydro reservoirs.
- Maximum energy spot price. High financial exposure on Gx and Dx. Government intervention to support the industry (financially: loans for 8 billions US\$S).
- **The situation began to return to normal because of increase in rain intensity**
- The same situation occurred in 2001: 20% electric rationing. The cost was 1,5% GDP



- Thermal generation dispatch to avoid using hydro reservoirs.
- Burning hydro plant: 560MW and fault thermal plant: 230 MW. 11% of firm energy
- 07-03 energy saving measures aimed at consumers.
- Resigned Minister of Mines and Energy
- **5% saving energy to avoid rationing. Estimated cost of 1% GDP.**
- The same situation occurred in 1992: 3% rationing. The cost was to 2-2,5% GDP

The energy sector has greater robustness to extreme hydro stress

Current Regulation: Auctions



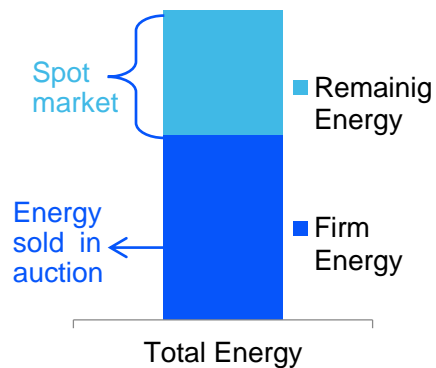
Generators can sell at auction their energy firm



- Distributors must contract 100% of its demand
- Differentiated technologies auction
- Long-term contracts (20-30) years for new plants depending on the technology
- Price in Reais (R\$) with IPCA indexation
- Descending Clock auctions (Hybrid)



- No obligation energy contract (Distributors and Free Customers)
- Auctions are not differentiated by technology
- Validity period of the obligations 20 years for new plants
- US dollar price
- Descending Clock auctions (Hybrid)



Long-term **decreases** the financial risk for the investor

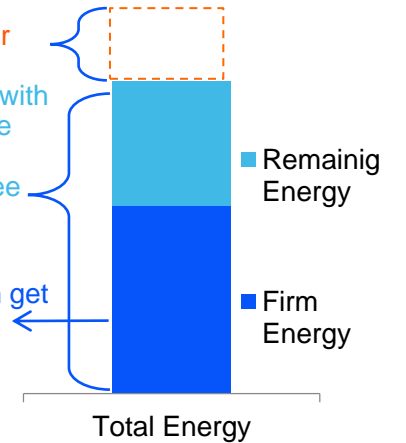
Long-term **increase** the risk of exposure to extreme events



Can sell more energy=marketer

It can be traded with Distributors, Free Customers and Spot Market. Free conditions and prices

In auction get the CxC

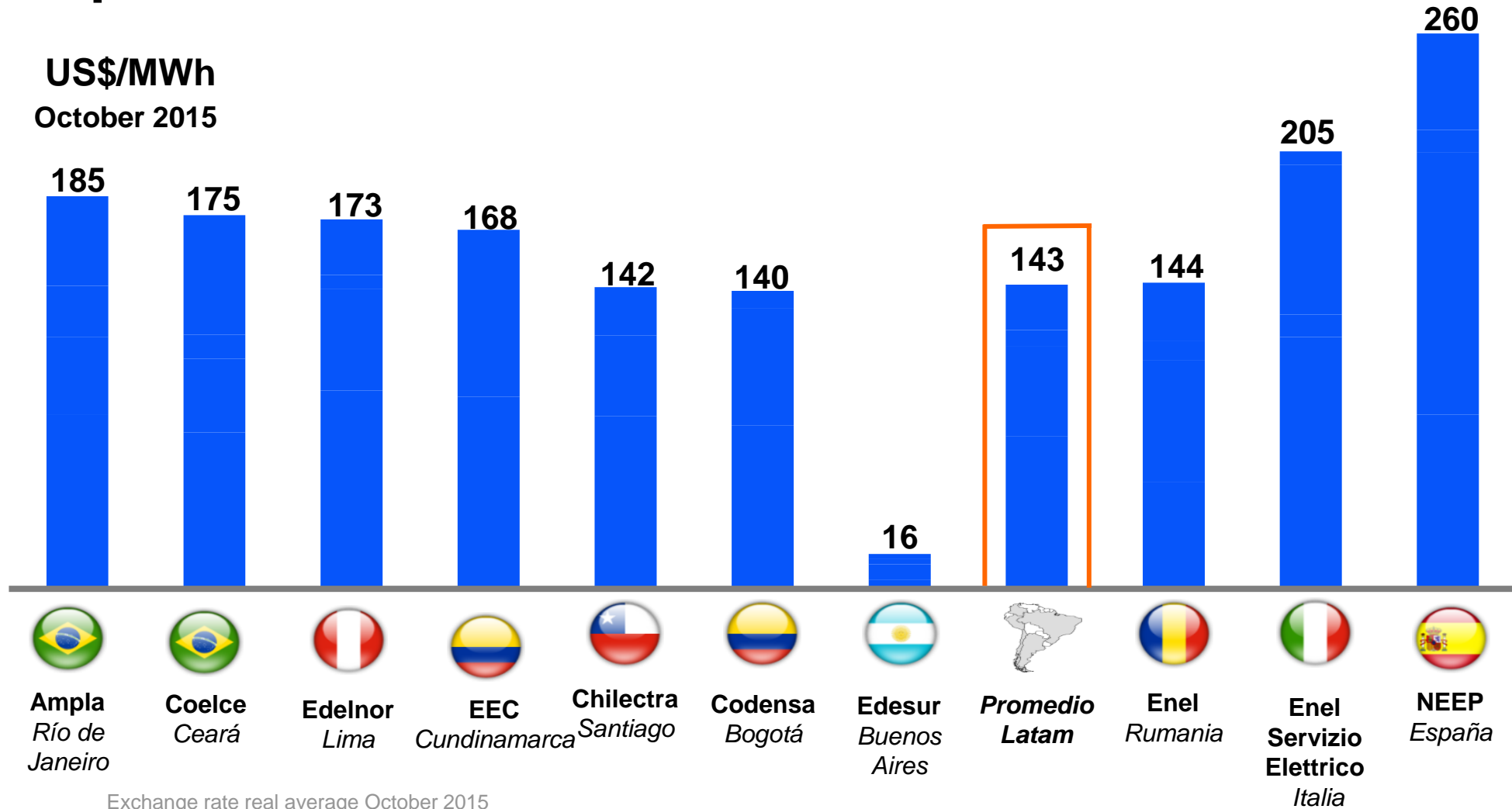


Residential customer price Including Taxes Consumption 200kWh-month



US\$/MWh
October 2015

- Taxes
- Commissions, grants, canon, subsidies and other
- Distribution and Marketing (D&M)
- Generation, Transmission



Issues to review...

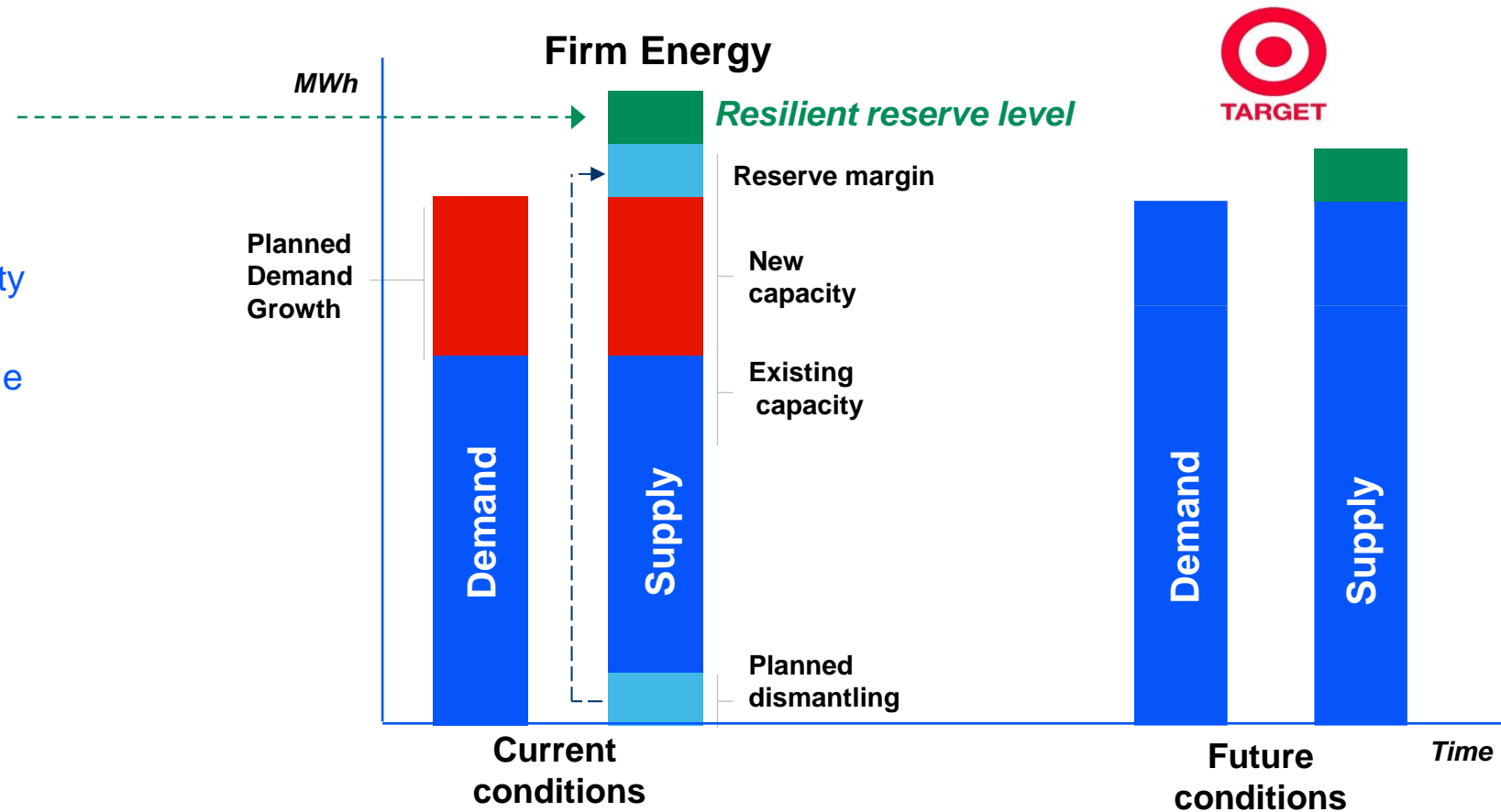


- This is an opportunity to adapt the rules to provide more resilience to the system
- To the estimated energy firm can be assigned a reserve level Resilient

Expansion Planning

- In Brazil there are auctions security reserve supply
- In Colombia, Creg adds a % to the growth reported by agents.

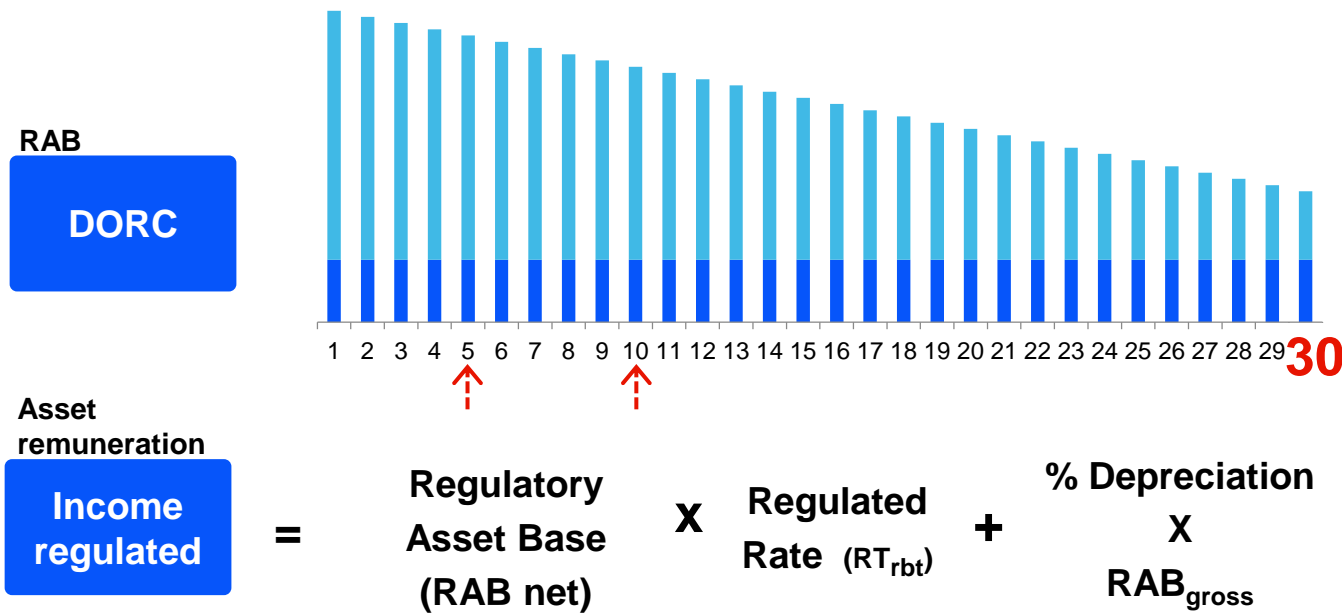
System has to face n-2 situation



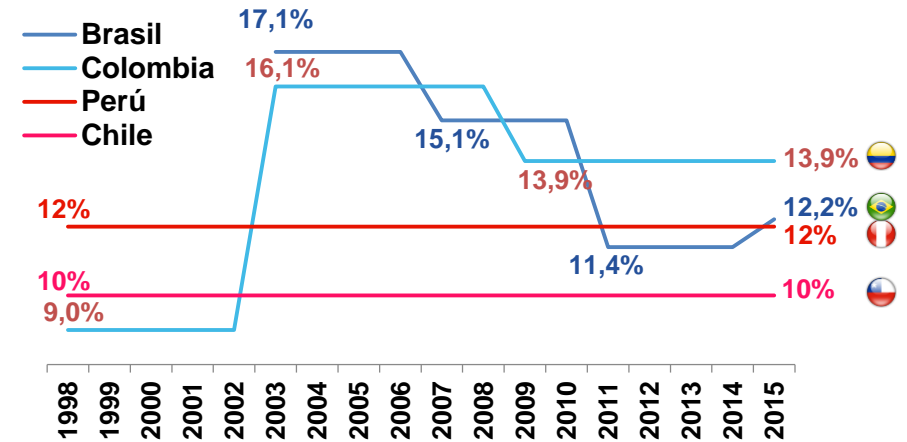
Issues to review...



- The Transport and Distribution sector should also be designed to withstand peak loads related to extreme events. Investments in smart grids and smart metering are a tool to mitigate
- Tx and Dx Asset remuneration using DORC. Safety in investment remuneration. Destructive damage is not paid.
- Useful life assets from 20-30 years, equivalent to depreciation time.
- Decouple the depreciation from capital remuneration: accelerated depreciation in areas of risk assets.



Wacc and regulated rate r.b.t (Distribution)



Issues to review...



- Renewable energy is the best option to increase the resilience of generation systems
- Renewable energy have predictable costs, faster operational startup, gives flexibility to the system and produce no emissions.



Thank you

