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Demand Response: a survey on Challenges and Opportunities

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EEIC 2016
Lisboa – Portugal - Fevereiro de 2016

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Introduction

- A growing share of variable renewable energy on most countries in the world demands for a more flexible power system

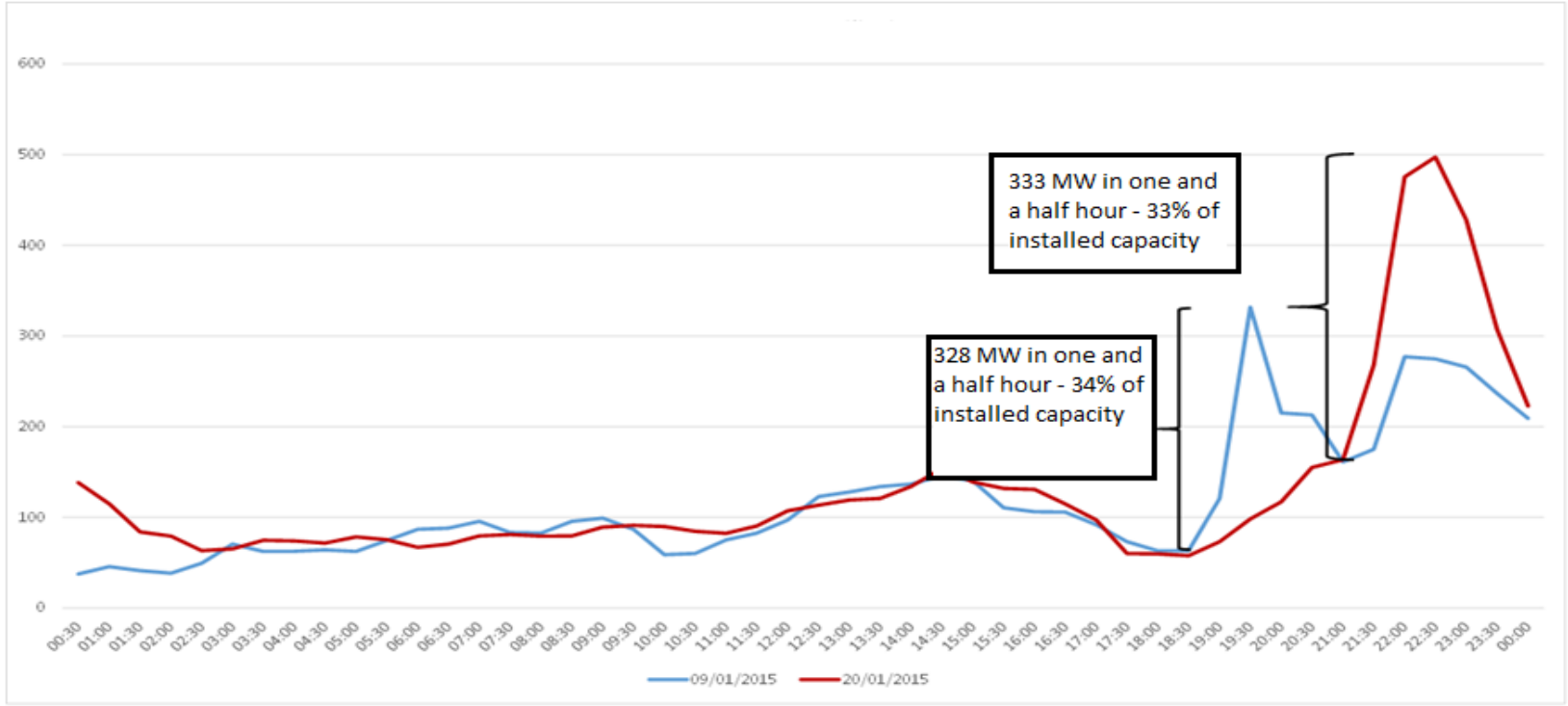
- Demand response is one of the main sources of flexibility, and according to IEA, is the most promising one

- The objective of this article is to examine some of the main challenges and opportunities for enabling demand response programs, taking some lessons from the international experience. An additional effort is to focus on Brazilian case

Opportunities

- Variable renewable energy insertion on power systems may impose several operational challenges (which may be seeing as additional incentive for demand response development)

A Brazilian wind plant intermittent profile. Days: 09/01/2015 and 20/01/2015.



Source: ONS

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Opportunities

- Demand response can postpone or even prevent further investments on grid

Investment scenarios for grids reinforcement in Great Britain.

	Without DR programs	With DR programs
Penetration Level	Total Investment (£bn)	Total Investment (£bn)
10%	5.1	2.2
25%	13.0	4.7
50%	25.5	11.1
75%	33.8	18.7
100%	38.8	22.2

Source: G Strbac et al (2010)

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Challenges

- On the regulatory side, lack of incentives to its implementation can become a barrier if a cost-benefit analysis results in a small margin

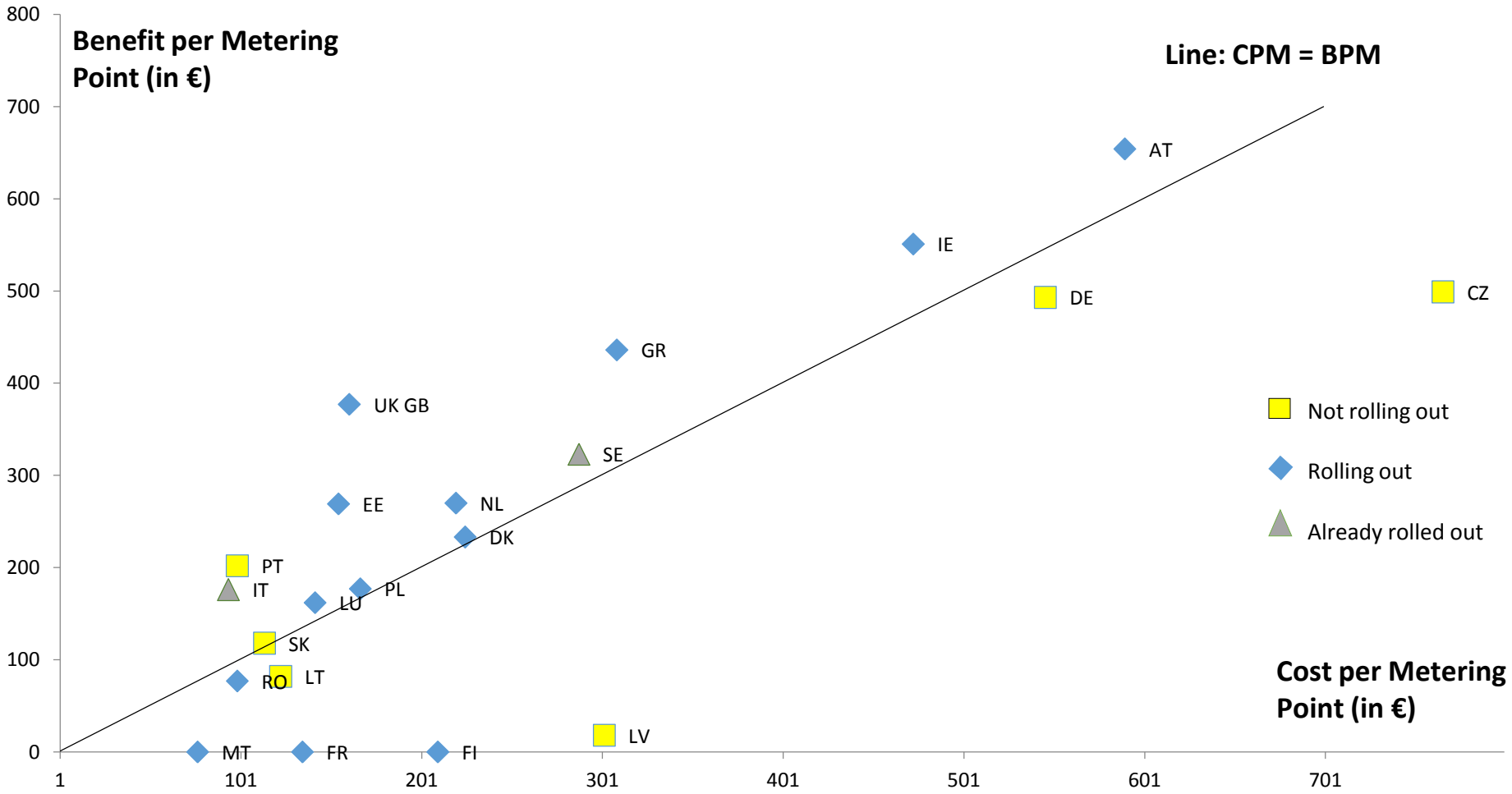
- Another difficulty can arise from a regulatory framework that does not provide clear incentives and/or a proper remuneration for the services provided by consumers engaged in DR programs

- Another important issue is the egg-chicken question related to the smart meters

- It was found that technological requirements of demand response might be a great obstacle, as observed in some of the European countries cost-benefit analysis and in the Brazilian case

Challenges

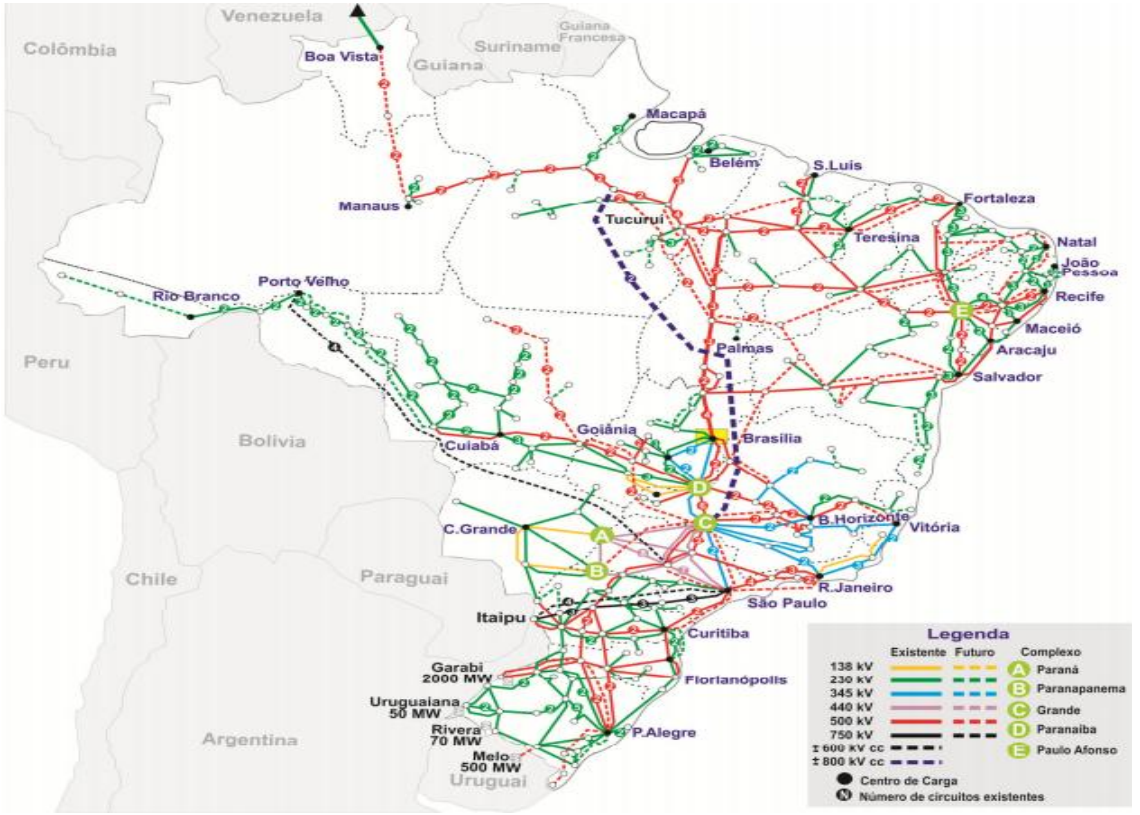
Summary of costs against benefits in countries in the European Union.



Source: EC SWD (2014)

Brazilian Power Sector Perspective

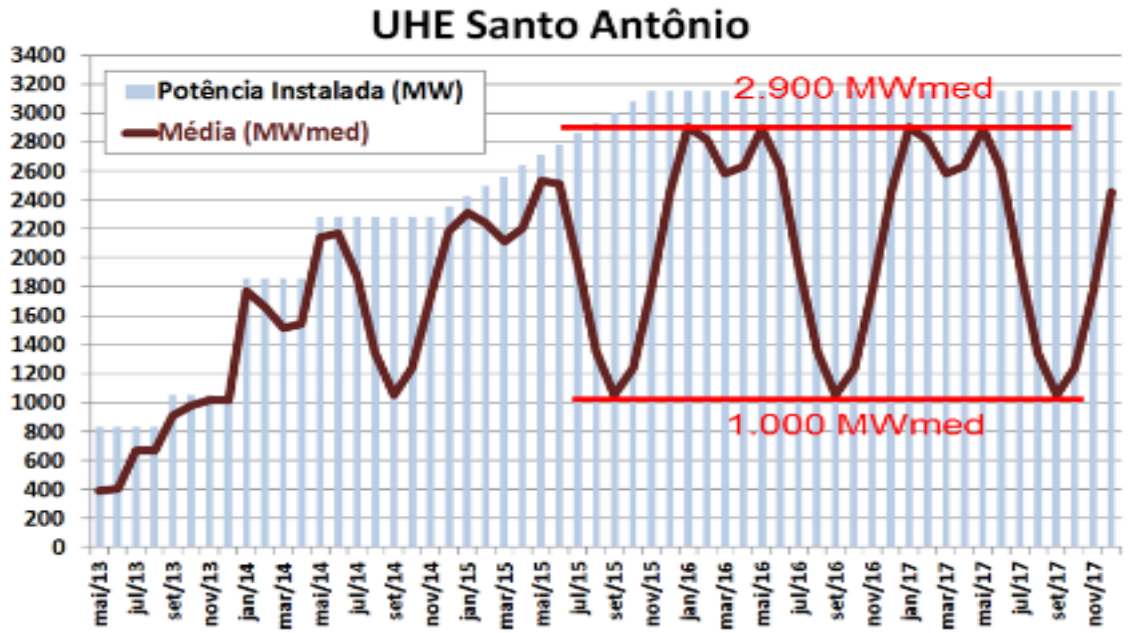
- Transmission GRID extension:
  - 119.426 KM in 2014
  - 195.154 KM expected in 2024
- The great wind potential in Brazilian northeast region brings some challenges
- Estimated investments in transmission grid expansion in the order of R$ 108 bi between 2015 e 2024

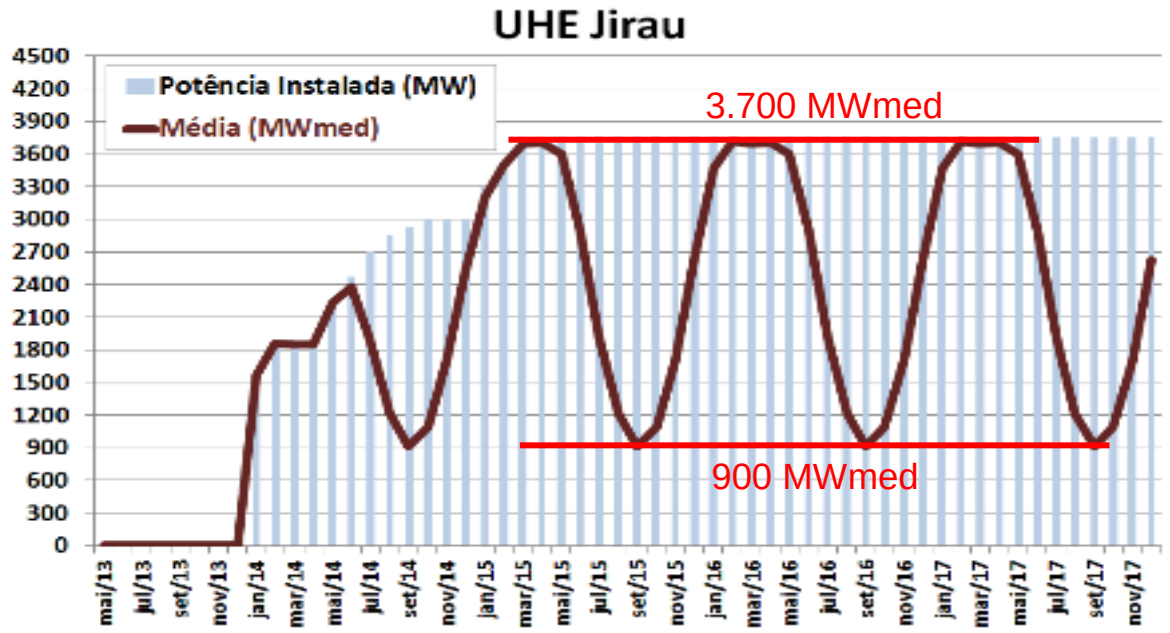


Source: EPE

Brazilian Power Sector Perspective

Non conventional renewable sources installed capacity increase (MW)

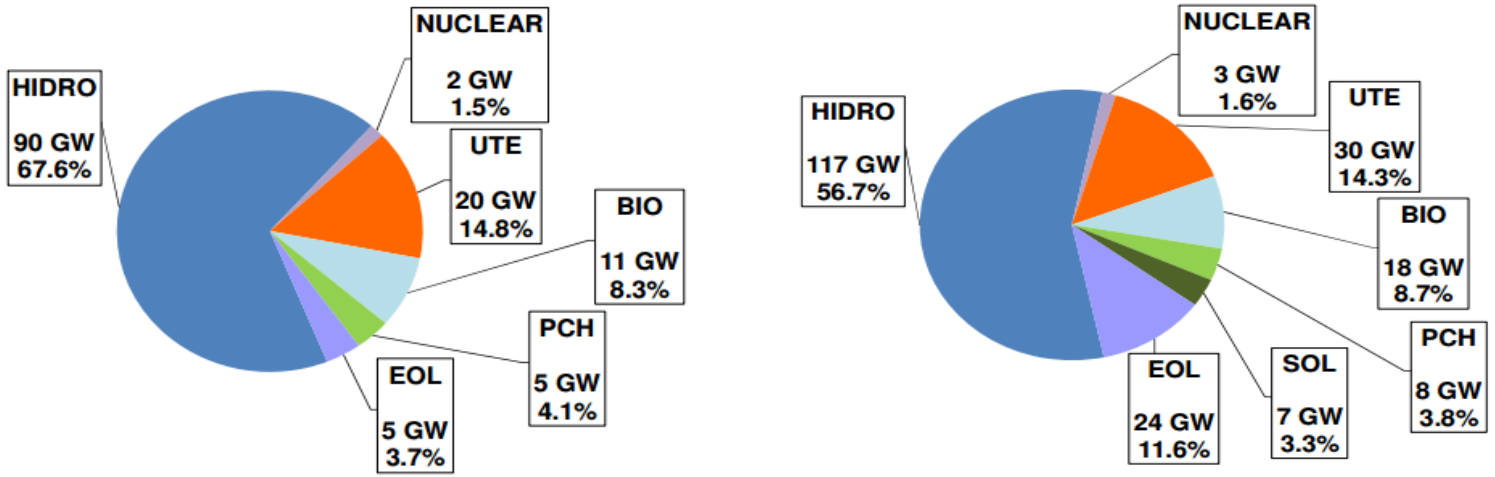




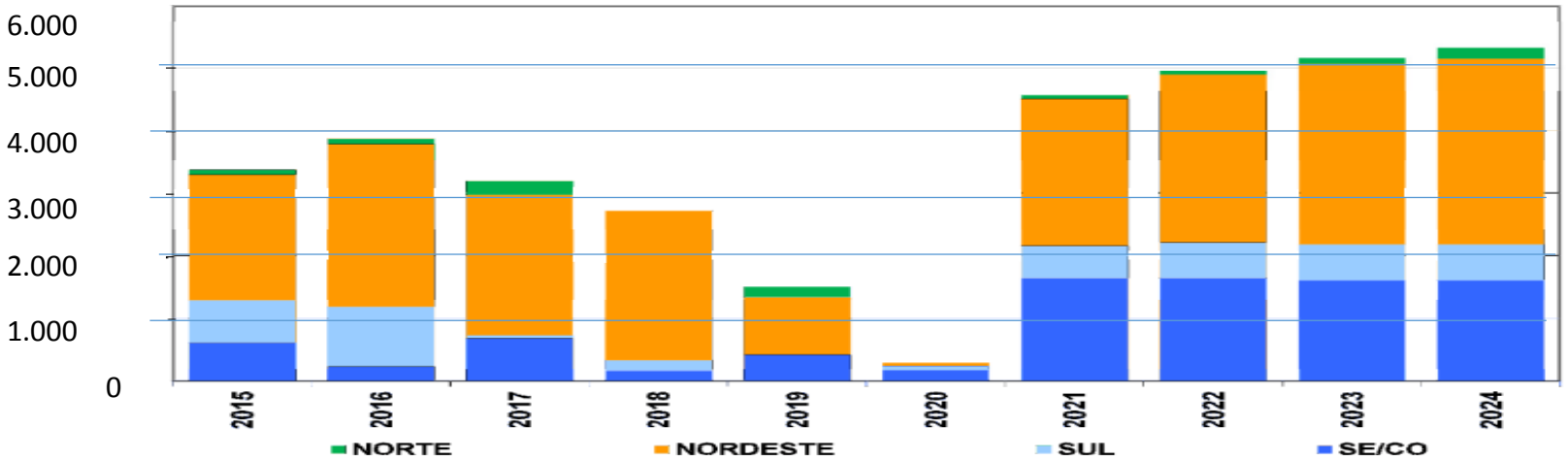
Source: ONS

Brazilian Power Sector Perspective

Installed Capacity evolution by source – 2014 e 2024



Non conventional renewable sources installed capacity increase (MW)



Source: EPE, PDE 2024

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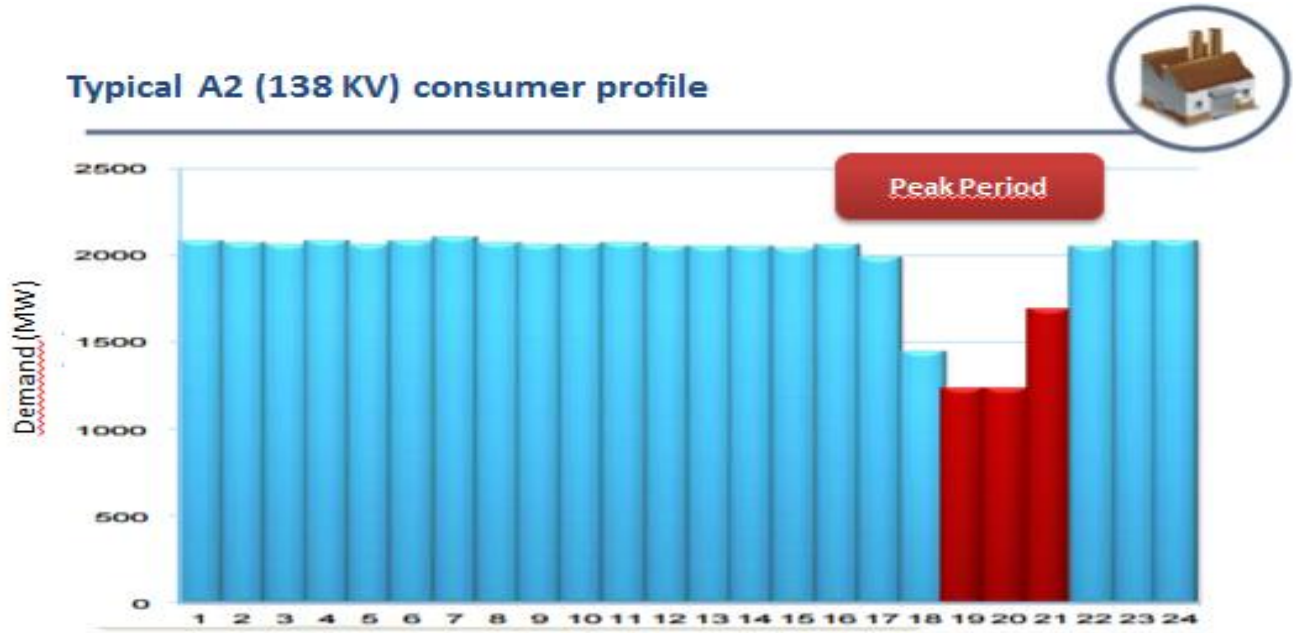
Brazilian Power Sector Perspective

- Albeit relevant, the enhancement of the grid, specially when aiming to increase energy interchange between different regions, is not enough to deal with the foreseen challenge;
- Controllable electricity generating centers are needed;
- In the long term, storage might become an alternative to deal with the raising share of intermittent and stochastic supply of new electricity generating sources in the Brazilian matrix. Still, economic and technical uncertainties are present in this technology nowadays;
- What about demand side flexibility?

Horoseasonal Tariff

- In 1988, Brazil initiated the application of demand reaction programs based on time of use tariffs (TOU), with the creation of time-of-day/seasonal (horoseasonal) tariffs
- Even though the intermittency and stochastic factors were not the addressed problems in 1988, the hourly fee represented a first step in the way of a more dynamic tariff



Source: ANEEL

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White Tariff

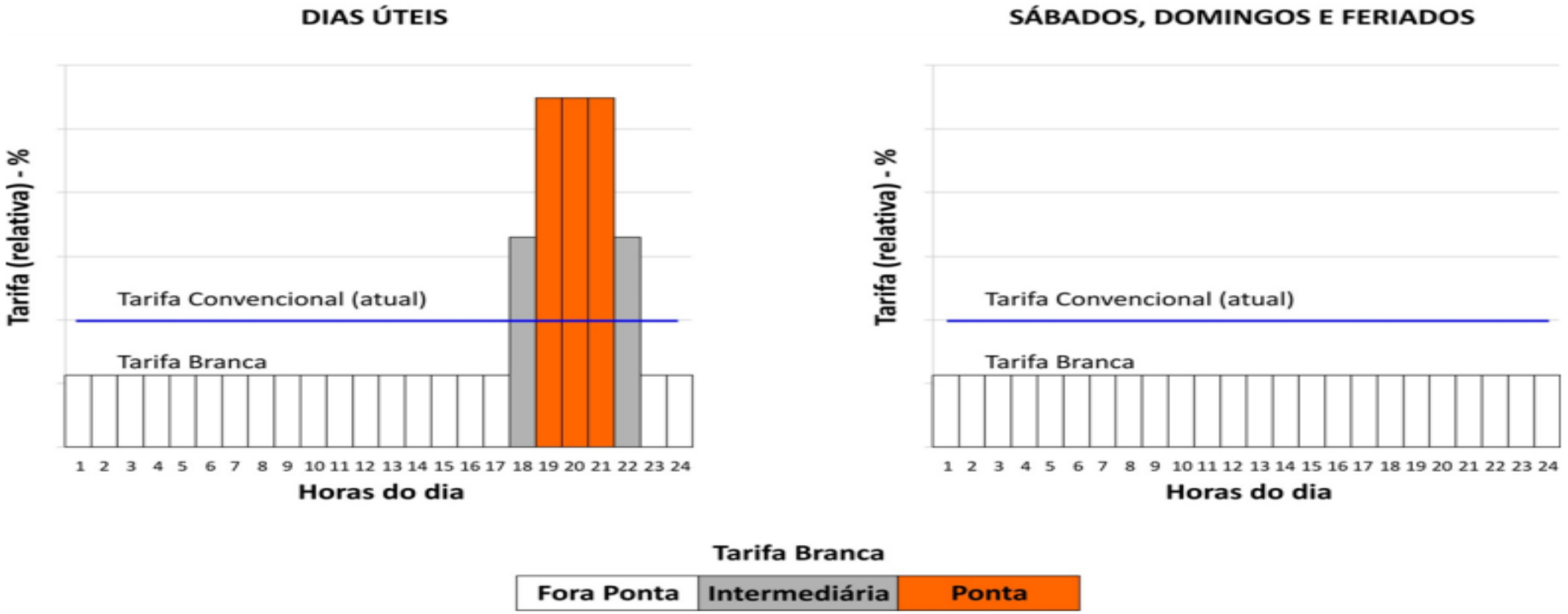
- The White Tariff is a kind of Time of Use tariff, designed to be applied to the lower tension consumers

- The adherence is facultative, and it communicates consumers about the electric energy price according to the day and hour of consumption

- The White Tariff can be seen as a first reaction to the forecasted and lately established new scenario, with loss of regulation capacity through reservoirs management and a more significant role of renewable, intermittent and stochastic, sources of electricity

White Tariff

White Tariff Directives



Source: ANEEL

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Tariff Flags System

- The most recent Brazilian experience with demand response is the Tariff Flags System, and it was created in order to mitigate the risks associated do the hydro crisis Brazil is facing

- The Tariff Flags aim to signalize consumers about the real power generation conditions, which is dependent on hydrological conditions and the need to dispatch thermal plants

- The Tariff Flags System is applied by all distribution companies connected to the National Integrated System

- This system can be seen as a strong reaction to a very adverse conjectural problem

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Final Thoughts

- The evolution of the electricity generating park in Brazil will require greater flexibility of the system;
- Demand side policy must be considered as an important alternative;
- The Brazilian Demand Response experiences are incipient only;
- The tariff flags system is not a genuine demand response program;
- Demand response is focused on great consumers;
- The White Tariff is unable to be implemented in face of an inexistent smart meter rollout;
- There are uncertainties about the price-elasticity of the demand from residential consumers of electricity

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Thank you

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