

# *Capabilities remuneration in a variability context – Challenges and opportunities for the Brazilian power sector reform*

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## **Overview**

The penetration of variable renewable energy (VRE), which currently has competitive costs and noticeable impacts, the proliferation of distributed energy resources and the development of smart networks point to radical changes in the power systems. In this context, active and multipurpose consumers - prosumers (producers, consumers and storage) as identified by Green & Staffell (2017) - challenge the centralization that historically structured the power sector, threatening to turn assets from utilities into stranded assets, in a process known as death spiral.

In this context of structural changes, the Utility of the Future report organized by MIT/Comillas (Pérez-Arriaga et al., 2016) prescribes general guidelines for new policies and regulatory frameworks. The main guidance is to improve the formation of prices and tariffs of the different power services, through adjustment of the wholesale and retail markets to better integrate distributed resources, remunerating the greater flexibility required. In general terms, the prescription is to improve market mechanisms in order to provide a unique environment of remuneration and competition for all technologies, betting on the signalling of more granular prices in time and space.

The formation of efficient power markets, capable of generating adequate signals and incentives, proved to be much more arduous than previously envisaged, making the pure commercialization of electricity insufficient to guarantee reliability and supply adequacy. Even countries that have adopted energy-only markets are introducing capacity remuneration mechanisms (CRMs) to ensure supply at critical times of scarcity - such as the United Kingdom, Italy, France and Germany. However, countries that contemplated CRMs in the original design, restructured their schemes and corrected failures in a second wave of reforms (Mastropietro, 2016; Batlle et al., 2014).

The significant penetration of VREs introduces a new critical period dimension, due to the variability and unpredictability of the sources like Solar and Wind, conditioning the reliability and adequacy of supply to the responsiveness of the residual system. The greater flexibility required can be provided by multiple resources - dispatchable generation, storage, interconnection, demand response and distributed resources - as long as they are adequately remunerated (Henriot & Glachant, 2014).

Rather than lacking adequate remuneration in established markets - missing money problem (Joskow, 2013, Spees et al., 2013) -, uncertainties of specific products or their future prices result in the inexistence of properly markets able to remunerate the resources, despite of its value to the system, which Newbery (2016) calls a missing market problem.

Originally structured from the restricted view of installed capacity for backup, CRMs tends to neglect the contributions of other resources and their capabilities to provide reliability under scarcity conditions. Thus, besides remunerating the installed capacity, the mechanisms must reward the performance at critical moments (Mastropietro et al., 2017).

This new orientation may allow greater convergence (mainly via price) between mechanisms aimed at supply adequacy (typically CRM) and mechanisms to support certain resources (typically VRE), favouring the constitution of a unique competition environment as advocated by Pérez- Arriaga et al. (2016). Analysing the experiences in Latin America (Brazil, Colombia and Peru), Mastropietro et al. (2014) identify the possibility of convergence but recognize that conventional and renewable sources still do not compete under the same conditions.

In Latin America, the main challenge is to ensure that the expansion of installed capacity accompanies the accelerated growth of demand. Centralized purchase auctions for long-term contracting are the remuneration mechanism found to mitigate the uncertainty in the cash flow of new investments and assets in operation. Due to the hydropower predominance in the region, in many systems the product is not capacity, but the energy itself (or a future purchase option). Thus, rather than ensure capacity in times of scarcity, auctions ensure the generation adequacy for all times.

The proposed restructuring of the Brazilian power sector, presented by the Ministry of Mines and Energy (MME) in the Public Consultation No. 33/2017, is insert into this structural changes context. Seeking the "modernization and rationalization" of the current model, the proposal was structured around the results of Public Consultation No. 21/2016, which aimed at identifying the challenges for unregulated (free) market expansion in

Brazil. Based on this objective, the proposed measures lead to the expansion of the free market as a solution for the improvement of the sectorial model.

The separation of "electricity and ballast" stands out among the several proposals raised by MME. The main purpose is to promote greater contractual freedom for the agents, thus directing the auctions just for "ballast remuneration". The "ballast" is related to the capability of the resources to deliver product or service, that is, a measure of reliability. The idea is to reward not a generic capacity, but a specific capability. In the current model, all contracted energy is backed by "physical guarantee" - a measure of expected "firm energy" provided in average (MWavg). Thus, the commercialization of energy is limited to the amount of "existing ballast". Although ballast is currently restricted to (physical) energy contribution, other types of ballast can be established, depending on the reliability product stipulated - for example, capability to meet peak demand or provide flexibility.

## Methods

Based on an literature review of academic articles and technical studies with different perspectives, the article identifies the structural changes underway in the power systems and inserts Brazil in this context. From this theoretical framework, the article discusses the risks, opportunities and challenges of the free market expansion in Brazil, with a special focus on the independent commercialization of ballast (capabilities) and energy (electricity).

## Results

The Brazilian power sector restructuring proposed by the MME can jeopardize the effectiveness of auctions in mitigating the uncertainty of future cash flows. In this sense, the definition of ballast would remain as a crucial parameter of the system and its long-term contracting as a pillar of expansion. On the other hand, the definition of ballast related to the specific capabilities of the resources would allow the remuneration of attributes that are not yet expressly valued - such as the provision of flexibility, both on the supply side (mainly by hydropower generation) and on the demand side. Thus, the energy pricing in the Brazilian system would become more adherent to the new short-term variability introduced by the VRE, signalling with more precision the opportunity cost of all available resources.

## Conclusions

The separation of energy and ballast unlocks the expansion of the Brazilian free market, but does not necessarily guarantee the supply adequacy. The free market grew with the leftovers of the regulated market, thus without anchoring the expansion of the matrix. The agent pressures for the free market expansion may cover disputes over appropriation of quasi-rent (derived from hydropower) and avoidance of sunk costs, in a process similar to the death spiral faced by utilities as discussed by Borenstein & Bushnell (2015).

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