Energy storage as an increasing important element in energy planning

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1. OVERVIEW

Energy storage in Brazil has been practiced primarily by means of reservoirs in hydroelectric plants. The use of water for energy storage has also been adopted by pumped hydraulic storage systems (PHS) (DOE, 2011). Historically, the development of energy storage technologies in the electricity sector has been driven by the challenges of dealing with demand fluctuations by operating thermal plants and, in the Brazilian case, with hydric seasonality.

The latest interest in the improvement of various existing technologies and the development of new ones has been primarily driven by the expansion of intermittent renewable sources (IRS) (POOLE, 2015). While some energy storage technologies are in mature stage or are about to be consolidated in the market, many are still incipient and face challenges to compete with other energy supply technologies due to their high costs so far identified (IEA, 2014).

Energy storage technologies are able to offer several services to the energy sector and in particular to the electricity grid, as they can be applied to both management of electricity supply and power quality services. However, their diffusion in electrical systems requires planning, and its adequation to the context to which they are applied depends on considering site-specific technical, economic, social and environmental factors. The concern about how much the IRS can penetrate the grid before energy storage employment is needed is fundamentally an economic issue with no simple answer, in view of the necessity to understand the availability and costs of network flexibility options, attributes varying from region to region. The ability to simulate the impact of the costs and benefits of energy storage in the network is still limited, given the current available methods and data (DENHOLM et al., 2010).

2. METHODOLOGY

This paper presents a literature review contemplating how electricity storage has been considered in the context of energy planning. Some planning methodologies and their applications are considered in this work, as well as international experiences and recommendations including tariff and regulatory mechanisms.

3. CONCLUSIONS

- Planning the inclusion of energy storage technologies in electrical systems requires consideration of their technical performance and economic implications, so that the offer is available when required.
- There are computational tools and simulation methodologies for considering energy storage on the electrical network, although some are quite limited in terms of planning time horizon and quantity and types of technologies embraced.
- It is important that all the potential benefits and possible drawbacks of energy storage technologies are recognized in the process of mid- and long term planning, including incurred and avoided costs in the long term within the electrical system.
- The electric energy storage can figure not only as a competitive technological route against other flexibilization strategies for grid integration of IRS, but also in relation to traditional sources of electricity. However, they cannot currently compete in the electricity market without financial incentives and regulatory actions.

- The costs of electricity provided by energy storage technologies depend on technical and economic characteristics of the local electricity grid, notably the capital costs of technologies, the purchase price of electricity and regulatory mechanisms to ensure both an economically viable operation of these technologies and a pricing system which is not only suitable to the remuneration of electricity supply assets, but also to the social context in which consumers are situated.

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