FROM SMART TECHNOLOGY TO SMART CONSUMERS: FOR A BETTER SYSTEM RELYABILITY AND IMPROVED MARKETS' EFFICIENCY.

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Overview

The new pricing schemes, enabling smart grids technologies and remote control equipments allow retail consumers to procure demand response resources and participate more intensely in the efficient functioning of markets. This fact is inducing significant changes regarding the roles historically attributed to the different operators acting along the supply chain. It is also involving improvements in markets efficiency, system reliability, and of course regulatory models. The numerous experimentations and deployment plans of smart grids technologies led worldwide already give significant insight into these different topics.
This paper aims at focusing on two different benefits, although not incompatible, of smart technology and retail consumers' activation.

- The first focus lies on smart grids technology's potential and on smart consumers in enhancing the reliability of power systems. Reliability and supply continuity are major challenges. They are exacerbated by fast growing peak load and ambitious targets of fluctuating energy integration. What is more, they are constrained by GHG emissions cuts' objectives and limited capacities. Smart technology leads the way to better monitoring and control of the demand side. This implies that the roles of suppliers, utilities, aggregators and system operators have to evolve. Consequently, both market and regulatory rules have to change to induce the maximum benefits of this technology.
- In turn, the second focus is based on the potential of smart grids technology to improve markets efficiency. First regarding wholesale energy markets. It allows consumers to react to effective price signals and consequently limit both price spikes and strategic behaviours. Second, retail demand flexibility seems to be a reliable tool on capacity markets, when they exist, or in the capacity requirement mechanism. Finally, if the functioning of wholesale markets has traditionally been a key concern since the first markets opening reforms, smart technology is very likely to refocus attention downward of the supply chain, and the retail market. The spreading of smart grids technology is already considered as an opportunity to complete and/or strengthen the competition in the supply of energy. In turn, it involves a clear definition of the boundaries between what remains regulated and what does not.

Regarding the many aspects contained in these two –restricted- sides of benefits, this paper is articulated in four points. First, it briefly recalls the main aspects of smart technology and the state of the art knowledge gathered on the demand activation topic. Second, it describes the challenges linked to system reliability and discusses the instruments becoming available through short-term demand side activation as well as the barriers to procure greater flexibility. Third, this paper deals with demand response as a way to enhance markets efficiency on the long run. At last, it discusses the regulatory mechanisms available to the authorities to give the sound incentives, according to the real needs encountered by the system.

Methods

This study aims to compare the theoretical inputs brought by power economics literature and practical applications. It follows an empirical methodology built on an extensive research based on four case studies. The author decided to pick up two U.S. states and two European countries that are relevant in illustrating the elements above mentioned. On the first hand, the adoption of smart grids technology in California and Germany will be used as a basis for analysing its benefits regarding short-term reliability. On the other hand, the state of Illinois through the utility Commonwealth Edison and the UK will serve as a basis for discussing the benefits of the technology in the markets efficiency field.

Results

The major output of this study is to demonstrate that what is often considered by the literature as the best option is rarely adopted. Indeed, the gaps remain sometimes huge between the optimal of smart technology and what is effectively implemented. The reasons to explain this are numerous: lack of feedback, lack of political/institutional will, risk of inertia regarding consumers' behaviour changes or lack of a truly integrated view of a smart system.
Of course, a trade-off has to be established between the long run costs of the measures to be adopted and their marginal impact. What seems clear however is that the complexity and diversity of power systems impede an

easy decision-making process regarding investments and regulation. This study aims at giving a better insight of the challenges, barriers and tools to be used by the decision maker and to give recommendations for fine-tuned policies.

Conclusions

Time has passed since the first efforts made to develop smart technology and to make smart consumers emerge. Both the U.S. and the European Union are involved in ambitious smart grids projects and we, consumers, will sooner or later increasingly be involved in our respective power systems.

The results drawn from the pilot projects led worldwide lead unanimously to the same conclusions; demand response resource brings major benefits in improving both system reliability and market efficiency.

New mechanisms and products developed by load serving entities or system operators have been rapidly emerging for a couple of years now. Institutions are showing an increasing interest in driving the actors to undertake the best actions disregarding their own private interest. However an effective integration of such a resource depends on two main elements: the equipment of consumers in smart technology and the definition of clear and adapted rules.

Accordingly, regulatory authorities have to play a key role in making the system and markets converge with the demand side. Alongside with smart instruments, smart mechanisms and regulation are appearing. However, questionings are arising whether or not the adopted initiatives are the most suitable and how their implementation effectively integrates in a wider regulatory and organizational environment. This paper proposes an enlarged understanding of the merits and inconveniences of demand response resources, related to both the reliability issue and the effectiveness of markets and emphasizes solutions for the authorities to adopt.

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