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Two smart energy management models for the Spanish electricity system

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ABSTRACT

This paper evaluates two smart energy management models for the Spanish electricity system in terms of power consumption savings, CO_2 emissions, and dependence upon primary energy from abroad. We compare a baseline scenario with two alternatives. The first model entails the reduction of the power demand through energy savings measures, smart meters, and self-supply. The second model entails the application of all measures included in first scenario, plus measures oriented to electric vehicles. For each model a sensitivity analysis was performed. Results show that both models can result in reductions of peak loads, CO_2 emissions, and energy dependence.

1. Introduction and overview

Implementation of a smart power grid could facilitate the integration of all users connected to it (producers, consumers, and "prosumers" or producer-consumers, as described in Crispim et al., 2014), to ensure efficient and sustainable electricity supply, with reduced power losses, lower emissions, greater reliability, and security of supply (EU, 2012a). Smart grids also allow greater involvement of the final consumer, who thus becomes the lead manager of the energy consumed (Vijayapriya and Kothari, 2011). Smart grids contribute substantially to the transition" toward a more decentralized and sustainable energy system. In this regard, a smart grid is a socio-technical network characterized by the active management of both information and energy flows to control

concluded that the keys to developing smart grids are: (1) lower market concentration in the electricity distribution sector; (2) the use of incentive-based regulatory schemes; and, (3) the adoption of innovation-stimulus mechanisms.

Utilities play an essential role in the implementation of an intelligent energy management system based on energy saving, improved energy management, self-supply, and electro-mobility. To a large extent, these companies will implement the various measures proposed.

Smart systems for energy management requires substantial investment and in-depth information on the energy system, the environment, the economy, and society.

This paper compares a baseline case with two alternative models (named as 3S and 3S + EV) to calculate the extent to which alternative