

Costs impact of a transition to hydrogen-fueled vehicles on the Spanish power sector

J. Villar Collado; B. Olavarría García-Perrote; S. Doménech Martínez;
F.A. Campos Fernández

Abstract-

It is expected that demand response might provide soon ancillary services to the power system. This could be done, for example, by managing the use of Electric Vehicles (EV) batteries, or the production of flexible energy commodities such as hydrogen (H₂), that can be used for fuel cell vehicles (H₂EV) or in industrial processes. This paper analyses the impact of a transition to H₂EV as an alternative to EV for passengers' cars on a Spanish-like power sector. A simple H₂ demand estimation is developed and provided to CEVESA, an operation and expansion model for the Iberian Power System Electricity Market (MIBEL). For this study, CEVESA was extended to include the investments and operation decisions of H₂ production. Simulations were performed to determine the optimal evolution of the H₂ production capacity and of the electricity generation mix, considering scenarios with different shares of EV and H₂EV. The impact of H₂EV vs EV mobility is assessed based on the recent Spanish National Plan for Energy and Climate (NECP) as the base case scenario. Results show that, even if H₂EV mobility alternative is still more costly than EV, H₂ production could provide a significant flexibility to the system that should also be appraised. Indeed, H₂EV mobility could become a feasible and complementary alternative to decarbonize mobility by powering H₂ production with the renewable generation surplus. This, together with the on-going learning process of this technology that will decrease its production costs and increase its efficiency in the coming years, could boost, even more, the development of the H₂ economy.

Index Terms- Hydrogen fuel cellEnergy transitionElectricity marketRenewable generationNECP

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