

# **Impact of vehicle-to-grid on power system operation costs: the Spanish case study**

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## **Abstract-**

Climate change, added to security of supply concerns, has been leading many countries to strongly support the development of electric vehicles (EVs) not only as a cleaner and more energy efficient source of transportation but also as a flexible electricity storage option. However, the massive deployment of EVs will impose important challenges to power systems operation. In this context, this paper investigates the impact of EVs with V2G capability to power system operation. Since this impact depends on the power system considered and on the number (and type) of EVs, different scenarios for renewable energy sources (RES) generation and EV penetration are studied. A detailed analysis of the impact of EVs the Spanish power system - demand, generation, use of flexible units (pumped storage) and power reserve, and energy curtailment - is performed. For this purpose, a mid-term operation model that computes generation dispatch and simulates hourly power system operation is used. The advantage of this model is that it includes EVs in the unit commitment and represents in detail mobility and connection patterns, which allows the estimation of more realistic results.

**Index Terms-** Electric vehicle, vehicle-to-grid, power system operation, operation costs

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## **Citation:**

*Fernandes, C.; Frías, P.; Latorre, J.M. "Impact of vehicle-to-grid on power system operation costs: the Spanish case study", Applied Energy, vol.96, pp.194-202, August, 2012.*