EDITORIAL
published: 03 May 2022
doi: 10.3389/fenrg.2022.896812

Editorial: Electric Mobility in Smart Grids

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Keywords: electric mobility, smart grids, renewables, energy storage, power quality 10

Editorial on the Research Topic

Electric Mobility in Smart Grids

OPEN ACCESS

Edited and reviewed by:
SM Muyeen, Qatar University, Qatar

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Specialty section:
This article was submitted to Smart Grids, a section of the journal Frontiers in Energy Research

Received: *15 March 2022*
Accepted: *05 April 2022*
Published: *03 May 2022*

Citation:
Monteiro V, Afonso JL, Ricco M, Monteiro LFC and Grandi G (2022) Editorial: Electric Mobility in Smart Grids. Front. Energy Res. 10:896812. doi: 10.3389/fenrg.2022.896812

INTRODUCTION

The synergetic cooperation between electric mobility and smart grids will encourage collaborative engagement by different players in the energy market, offering sophisticated management and control approaches. Therefore, new advances and innovative technologies toward such cooperation are of preeminent importance. To ensure excellent power grid performance and stability considering the scope of different solutions of electric mobility in the context of smart grids, power quality aspects must also be considered. For this purpose, the introduction of innovative technologies of renewable energy systems and energy storage systems are seen as fundamental to encourage and facilitate the spread of electric mobility and smart grids. Furthermore, based on collaborative and concerted operation, it is possible to accomplish environmental targets and accommodate electricity demand.

Considering scientific and industrial evaluations, principally in the last few decades, the technologies linked with electric vehicles (EVs) have attained significant importance and, nowadays, several research studies are directly related to technologies for EVs. Moreover, for the coming decades, it is expected that EVs will be even more necessary to transform the actual scenario of the transportation sector. It would lead to extending the natural advantages of electric mobility (e.g., reducing greenhouse gas emissions), also to the full and intensive participation of the end user and in the perception of the electrical grid, where the opportunity of contribution with advanced operation modes for ancillary services is of the utmost importance. This perspective is even more relevant in a smart grid context. In the perspective of smart grids, the introduction of electric mobility can be enriched if the necessary electricity to charge EVs is produced by renewable energy sources. Moreover, this approach is further pertinent if contemplating the production from renewables near the consumption by EVs, enhancing the power transfer among both technologies. However, the success of the electric mobility introduction will be greatly determined by their impact on power systems, where, for instance, the development of technologies such as EV chargers, battery management systems, and battery technologies, is fundamental. To summarize, the research and development of sophisticated technologies for electric mobility is of paramount importance, aiming to represent a significant asset in the management of smart grids.

The Research Topic of Electric Mobility in Smart Grids aimed to organize and originate a guideline for future perspectives of electric mobility and smart grids, including all the related contributions with these subjects. Therefore, academic scientists and researchers, including MSc and

Ph.D. students, as well as professional communities, were welcome to submit their original works. The topics of interest for publication included, but were not limited to: 1) Advanced technologies of on-board and off-board bidirectional chargers (i.e., V2G, G2V, V4G); 2) electric mobility in on-grid and off-grid scenarios; 3) unified systems for electric mobility, renewables, and energy storage systems; 4) electric mobility integration in industrial, commercial, and residential scenarios; 5) technologies of wireless power transfer for electric mobility; 6) innovative solutions for energy efficiency in transportation; 7) integrated solutions for charging and propulsion systems; 8) technology and innovation for railways; and 9) power quality, reliability, and security.

The widespread topics covered in the submissions demonstrate the interdisciplinary view concerning essential aspects associated with electric mobility in smart grids, which are now widespread among the scientific community. The published papers enclose a broad range of thematic topics, including: Battery; battery state of charge; charging demand; charging management system; driving behavior; droop control; electric vehicles; island grids; microgrids; parking lot charging station; parallel converters; power sharing; renewable energy sources; smart charging; and vehicle-to-vehicle mode. **Section 2** presents a short review of the submissions for the research topic "Electric Mobility in Smart Grids", highlighting the main contributions and achievements of each paper.

CONTRIBUTIONS: A SHORT REVIEWAUTHOR_CONTRIBUTION

The microgrid concept, connected or disconnected, from the main grid, is an interesting solution, offering new advantages for the end user, where the penetration of renewables, new technologies of electrical appliances, and electric mobility are of paramount importance. However, it is necessary to deal with the power management of such technologies, also in the perspective of minimizing the impact and guaranteeing the stability of the power grid. In this context, power sharing in island microgrids is proposed Pinto et al., where a scenario of an island operation of a microgrid with multiple sources and multiple loads is explored, offering an innovative control solution for a stable operation of the microgrid in terms of both power balancing and power sharing. The validation was carried out based on numerical and experimental results.

The high dissemination of renewables and EVs is crucial toward zero-carbon energy communities, however, it is fundamental to a power management strategy to deal with the intermittent production from renewables and the uncontrolled EV charging demand. In this context, a novel smart charging strategy aiming to improve the integration between renewables and EVs, at the local level, is provided Lo Franco et al. The proposed strategy presents a centralized charging management system, which offers the possibility of individually modulating each EV charging power, maximizing the self-consumption from local renewables. Unidirectional (grid-to-vehicle) and bidirectional, i.e., power exchanged between EVs (vehicle-to-vehicle), power flows are considered leading to two different approaches. A set of relevant results are presented, considering different operating conditions and a probabilistic distribution of arrival and departure time of EVs based on real parking data, demonstrating the importance of proposed charging management algorithms.

In the context of electric mobility and aiming to demonstrate the potential to reduce emissions in the transportation sector, a study that uses GPS-measured driving patterns collected from conventional gasoline and diesel vehicles, aiming to evaluate the expected charging coincidence, assuming that such driving patterns were the same for EV is presented Hartvigsson et al. The study shows that the nominal EV charging power has the largest impact on after-coincidence charging power demand, followed by EV consumption and lastly the location of the charging station. The study also shows that the reduction in the EV charging demand, when the charging is moved in time, is major for a small number of vehicles and decreases when the quantity of vehicles increases.

AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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