TDA Training Program on Transport Decarbonisation

Module 9

Management of Electric Mobility

Deployment: Online / blended
Workload: 3 hrs
Extra learning: 2 hrs

Module working group:

- Pedro Filipe – Portugal (Leader)
- Bertrand Bonhomme - Michelin
- Daniel Freitas – Porto
- Paulo Humanes – PTV Group
- Pedro Faria Gomes - EDP
- Pedro Machado – CM Lisboa

Learning outcome

The major takeaways are a comprehensive approach to the electric mobility systems and its main components (value chain, major players, the charging network design and operation).

Illustrated by case studies, the student will become aware of different strategies, crosswise to all involved local actors (and municipalities), including case studies revealing challenges and opportunities for the management and operation of electric mobility, as well as asset-driven, energy-driven and data-driven businesses.

Syllabus

Module 9 is organised around to the following chapters:

1 Electric Vehicles (EV) market: evolution and perspectives for the future

EVs comprise a set of vehicles that embrace two-wheelers (e.g. scooters, bicycles, motorbikes), light vehicles, for personal transport and light duty vehicles, heavy duty vehicles, buses, etc. The growth rate of EV adoption is high as sales of new electric cars worldwide surpassed 1 million units in 2017 – a record volume. This represents a growth in new electric car sales of 54% compared with 2016. The global stock of electric cars surpassed 3 million vehicles in 2017 after crossing the 1 million thresholds in 2015 and the 2 million mark in 2016. It expanded by 56% compared with 2016. The same trends are experienced by the other market segments, to be discussed in this chapter.

The adoption of EVs is being motivated by several factors including, not only environmental factors, but also economic factors such as the Total Cost of Ownership (dramatically dropping and sometimes fostered by public incentives and regulation) to be mentioned, among others, in this Chapter.

2 Basic EV and battery technologies: evolution and performance perspectives

The students will become aware of the technology basics related to the EV, hydrogen and battery technologies. In fact, the dramatic evolution of the EV technology has contributed to level the major issues of the EVs when compared to the ICE vehicles (e.g.: fuelling / charging speed and autonomy).

3 National and international regulations on vehicle decarbonization

Transport decarbonisation acceleration requires major behaviour changes for the global economy. These changes are not easy and need to be incentivised and directed by the Governments. Several regulations have been discussed and implemented worldwide so that decarbonisation is effective asap. In this Chapter the students will become aware of the EU regulation for passenger vehicles, light-duty vehicles and heavy-duty vehicles. Each regulation has a strong impact not only on the demand side (users) but also on the supplier side (Vehicle manufacturers) that has to be considered when getting everyone on board for change and achieving transport decarbonisation before 2050. Even the aviation sector is working on electrification for small planes short flights.

There are a lot of opportunities to reduce GHG in the freight sector. The students should be aware that GHG reduction will be obtained by regulation on norms on the vehicle but also on the loading factor for freight and passengers (and then combine regulation and pricing).

4 Discussion on EV sustainability, including CO_2 mitigation and scarce materials use

The EV full lifecycle has to be considered including a wider "well to wheel" approach, discussed in terms of emissions and scarce materials usage. In fact, the manufacturing industrial processes, in particular those related with the batteries, have different impacts when compared to the ICE vehicles. Additionally, the most common batteries technologies, currently in use, require scarce materials extraction with high concerns related to environmental sustainability, supply reliability, geopolitical issues, among others.

5 Charging equipment: types and performance of EV chargers

Charging equipment is an important item of the full transport transformation. The current ICE vehicles user mindset is a fuel tank filling time to be compared to the EV batteries charging. In recent years, the charging equipment technology has evolved to become faster and safer. Nevertheless, all improvements are made at a cost, and fast chargers are more expensive than other chargers, some of them using older technology. The recent and growing adoption of electric passenger cars, Light Duty Vehicles and buses introduced new requirements, behaviour changes and new business models around electric mobility and charging requirements. This Chapter will address the major types and performances of EV chargers and will provide information on selection criteria according to each usage typical scenario.

6 Charging infrastructure: deployment and management models

The electric mobility is structured around layers, consisting of different players at various levels, each one adding specific value to the electric mobility value chain, integrating the EVs, Batteries, Charging points, Supplier of electricity for mobility, Services (beyond the basic charging service) and a Management system.

The Mobility management systems enable the layers integration, as well as information, financial and energy flows, interfacing energy suppliers, charging points' operators and EV users. The available data is a rich source of information to foster other cross selling options and new business models to take into consideration. The EV charging access facilitation and the associated billing process is also a fundamental and new activity, with several scenarios being adopted worldwide. Students will become familiar with several case studies illustrating such new businesses, and related challenges and opportunities.

7 Charging stations operation

EV demand growth is bringing a (good) pressure on the charging networks and operators, as well as in the financing and business side to enable the economic viability of the operation. This scale of publicly accessible charging infrastructure should accommodate the demand from EV users. There are already recommendations (e.g. EU Alternative Fuels Infrastructure (AFI) Directive), which suggests a ratio of one publicly accessible charger for ten electric cars. The ratio of publicly accessible chargers per electric car required, however, may end up being much lower than one charger for ten electric cars, as evidenced by the ratio currently observed in Norway – the most advanced electric car market in 2017 in terms of market share, where there is only one publicly accessible charger for 19 electric cars. The actual deployment of publicly accessible charging infrastructure in the coming years, in a large part, will depend on countries' and regions' strategies and policies regarding the availability of charging infrastructure in public spaces.

8 Electricity for EV: level of decarbonization, decentralized renewable + battery solutions and V2G potential

When considering a full "well to wheel" approach, with the objective of emissions cutting, the energy sources are of major importance. Therefore, the charging stations operators require an extensive access to renewable energy, and this is not fully available at each network point. Several solutions could be used to mitigate this requirement and to reduce the need to reinforce the electricity distribution and storage network, including decentralized renewable energy production and Vehicle to Grid (V2G) solutions.

On the electricity supply side, the market is evolving rapidly with specific cases of Electric energy providers, offering special commercial packages for EVs, or the EV charging points operators, getting synergic businesses with local shops / restaurants / hotels. This will also raise issues such as how to rate the price of the energy and organise the market for individual to supply energy for other (EV) users.

9 2-wheelers: electric bikes, scooters and motorbikes

The stock of electric two-wheelers reached 250 million in 2017. It is a major market segment with growing importance in the full Mobility system. Millions of 2-wheelers users commute every day and require infrastructure to move, to park and to charge. Several case studies will illustrate the major concerns to be considered and the most recent solutions for the cities today and in the future.

10 Fiscal and acquisition incentives

The mobility, i.e. the transportation system, can be considered the most visible aspect of the functional operation of cities. Electric mobility is one of the major solutions to dramatically reduce transport massive emission of noise and other types of pollutants, in which the greenhouse gases are included. But this option requires both public and private coordinated investment for a quick and successful deployment. As one of the most innovative clusters in the automotive sector, Electric Vehicles (EVs) have substantial potential to enhance economic and industrial competitiveness and to attract investment where major markets can be developed.

Case studies

In order to accelerate the electric mobility adoption, the Portuguese Government established a set of public policy actions including:

- Incentives channelled to EV acquisition: tax exemptions, free parking in specific cities, etc.;
- EV charging network infrastructure: pilot project implementation in 25 municipalities, creating a dynamic experimenting laboratory based on 1.368 charging outlets in phase 1, further progressing to a nationwide comprehensive EV charging network – phase 2 and 3;
- Universal management system: Mobi.E management entity based on an innovative information system Mobi.ME enabling the interaction of electric energy suppliers, charging points operators and EV users – one universal access card fitting all energy suppliers and charging point operators – ATM like.

The Portuguese policies resulted in a steep adoption of EVs doubling the sold vehicles every year, achieving a fleet of 20.000 EVs in 2018 (ca. 2% of total fleet).

Major references

EVI (2018) Global EV Outlook 2018 – towards cross-modal electrification (2018); IEA
https://www.connaissancedesenergies.org/sites/default/files/pdf-actualites/globalevoutlook2018.pdf
T&E (2018) Roadmap to decarbonising European cars, Transport and Environment - European Federation for Transport and Environment AISBL;
https://www.transportenvironment.org/sites/te/files/publications/2050_strategy_cars_FINAL.pdf