Matching electric vehicle deployment and charging infrastructure

IA-HEV outlook for hybrid and electric vehicles - 2011

Electric vehicles have no tailpipe emissions, and when powered by renewable electricity they contribute to reducing anthropogenic CO_2 emissions and fossil fuel consumption. Therefore they have gained the interest of authorities at national, regional and city levels as a means to achieve environmental objectives for the transport sector. Authorities in many countries have set targets for electric vehicle numbers in future years and created programmes for electric vehicle deployment. Car manufacturers also recognise the potential of electric vehicles and they have recently started producing battery electric vehicles such as the Mitsubishi i-MiEV, Nissan Leaf, Peugeot iOn and Tesla Roadster, and plug-in hybrid electric vehicles such as the Chevrolet Volt and the Fisker Karma. Most other car manufacturers have announced plans to introduce electric vehicles in the coming years as well. Besides authorities and car manufacturers, many other stakeholders are involved in the deployment of electric vehicles and in building up the infra-structure that is necessary to charge the vehicle batteries. Figure 1 presents an overview and it also shows the different factors that play a role in large-scale deployment of electric vehicles.

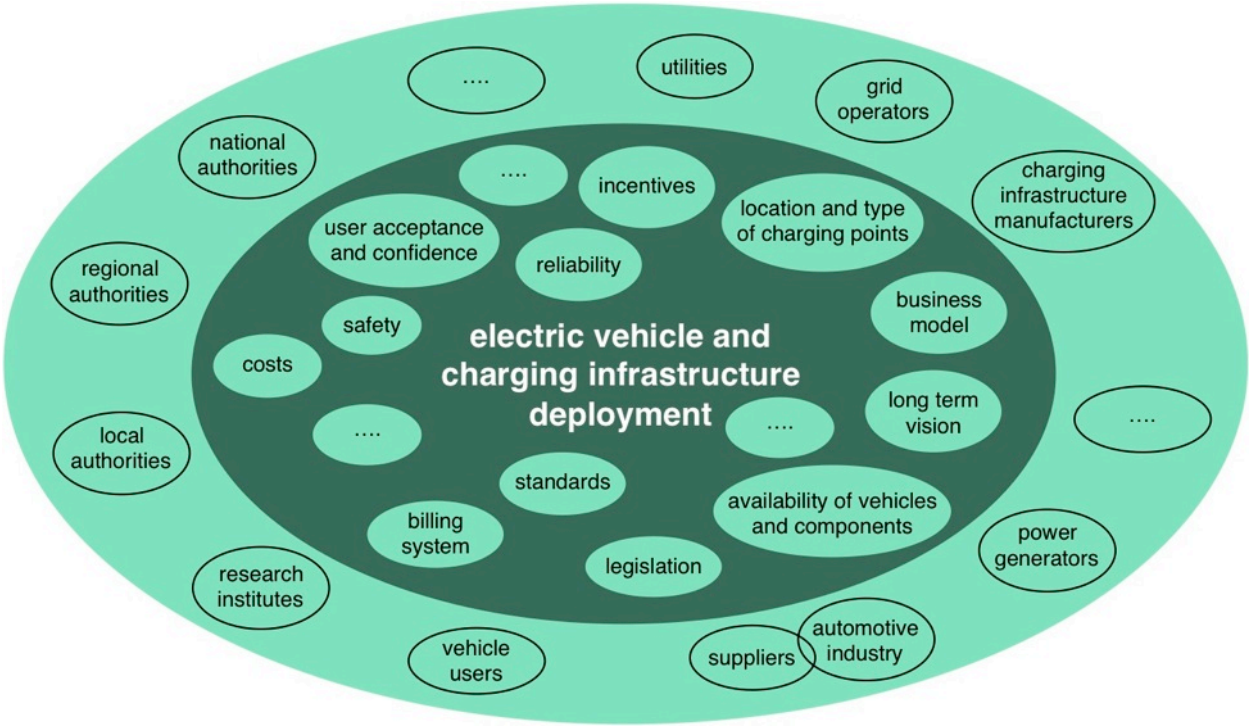

Fig. 1 Many stakeholders and factors influence the deployment of electric vehicles and building up the infra-structure to charge the vehicle batteries. (Stakeholders are shown in the outside ring and factors are shown in the centre.)

The promises of electric vehicles have made many people and organizations eager today to bring electric vehicles on the road. The enthusiasm has reached such a level that some people are now speaking of "electric vehicle hype", suggesting that electric vehicles cannot live up to these expectations. And indeed, the first bottlenecks for electric vehicle availability can be observed. Worldwide electric vehicle production is still small and it is far from meeting today's demand. The Danish aim to use electric cars running on wind power, but they have not been able to

substantially expand their electric vehicle fleet the last few years. Another example is that the Vlotte project to make Voralberg in Western Austria an e-mobility model region has delayed expanding the number of charging stations because there are insufficient electric cars available. And how about the longer term? When looking at just a few of the objectives for electric vehicle fleet numbers in IA-HEV member countries (see table 1), it is easy to imagine that the total worldwide objective might be tens of millions of electric vehicles on the road in 2020. Will the automotive and component industry be able to deliver these quantities by then? An IA-HEV workshop in December 2008 has shown that lithium supply for the vehicle batteries may be expected to be able to keep up with demand, but many other questions remain open. One question is related to the electric components that are necessary to build an electric car. Will it be possible to make components available in sufficient quantities? Another growing market sector shows that ramping up the supply chain is not always easy: in 2010 there was a shortage of components for power electronics in the photovoltaic industry, which limited the amount of solar panels that could be installed. Policy makers and decision takers need to take all of these kinds of issues into consideration when planning electric vehicle deployment.

Table 1 Examples of objectives for electric vehicle numbers on the roads in a few IA-HEV member countries and Germany.

	Objectives for all electric and chargeable hybrid electric vehicle numbers on the road in 2020
Canada	
Québec	118,000
Germany	1,000,000
Netherlands	
Amsterdam	40,000
Noord Brabant	200,000
Portugal (estimate)	200,000
Spain	2,500,000

The infrastructure to charge large numbers of electric vehicle batteries -especially in public areas- is in its infancy, and therefore authorities on all levels are establishing programmes to support the construction of this infrastructure. Today, many believe that a widespread presence of public charging points -including fast charging- is necessary to deal with range anxiety of vehicle users, which they consider one of the major hurdles for large-scale deployment of electric vehicles. On the other hand, from various IA-HEV Tasks it shows that electric vehicle pioneers and participants in electric vehicle demonstration projects adapt their mobility behaviour to the performance of the vehicle. They mostly charge the vehicle batteries at home, and public charging points are rarely used. They also indicated that they wanted a charging infrastructure that would help them reaching their destination. By doing so they expressed a range desire instead of a range anxiety. However, it is still unclear what the future vehicle and charging infrastructure requirements will be when there would be an electric vehicle mass market and the general public would be using electric vehicles on a large scale. So entities that

want to start installing charging infrastructure today have still questions about the number of charging points that are necessary, the location of these points (at home, at the workplace, in public parking areas, etc.), and if slow charging would be sufficient or if a number of fast charging points will also be required. It is therefore necessary to experiment and to learn along the way. Exchanging experiences at an international level considerably enhances this learning process.

The bottlenecks that are mentioned above show that it is important to carefully balance the construction of a charging infrastructure with the amount of electric vehicles that could be made available over time, to avoid investments in infrastructure that will be insufficiently used during its first years of operation. Therefore, besides the role of the vehicle users, the dialogue with the automotive and suppliers industries is a crucial element in setting up programmes and projects for the introduction of electric vehicles (figure 2). Some regions and cities have started this dialogue, but others still have questions regarding the supply of vehicles and the associated charging infrastructure that needs to be put in place. IA-HEV Task 18 "EV ecosystems" offers a platform for those setting up electric vehicle deployment programmes to exchange practices and experiences, and it includes discussing these issues.

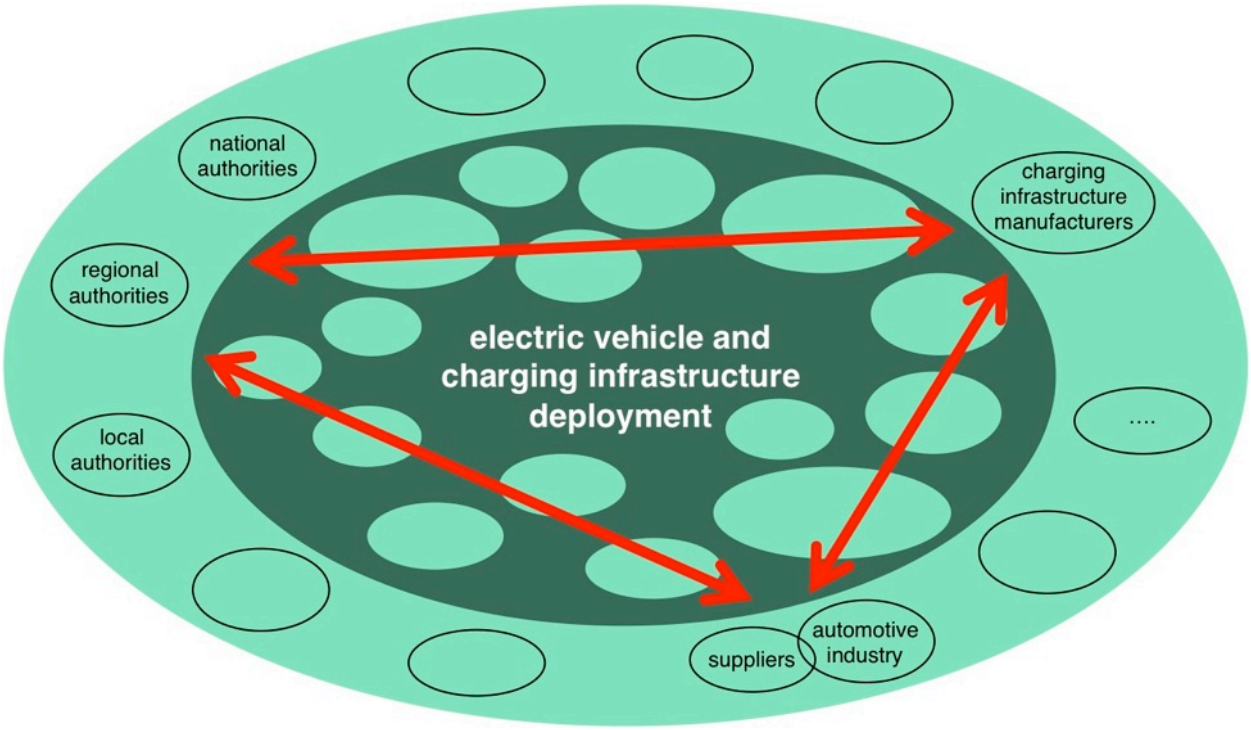

Fig. 2 Within all factors that play a role, the dialogue between authorities, the automotive industry and its suppliers, and manufacturers of charging infrastructure is a crucial element in optimizing the timing of investments for large-scale electric vehicle deployment.

In summary, it can be observed that building a large-scale electric vehicle fleet and its associated charging infrastructure is a major endeavour, in which many stakeholders play a role and with many factors that have to be taken into account (figure 1). In this complex environment the dialogue between authorities planning electric vehicle deployment and those who will have to deliver the vehicles and the charging infrastructure is a crucial element. The wishes of ambitious

planners must be balanced with the realities of product development and the time that is required to build sufficient production capacity, to guarantee appropriate levels of investments over time. This will contribute to a sustained deployment of electric vehicles, which are destined to play a role in meeting environmental objectives and increasing the sustainability of road transport.

IEA Implementing Agreement for co-operation on Hybrid and Electric Vehicle Technologies and Programmes (IA-HEV)
The current fifteen IA-HEV member countries are Austria, Belgium, Canada, Denmark, Finland, France, Italy, the Netherlands, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom, and the United States. The Executive Committee of the Agreement consists of people working for governmental bodies and research institutes, who are appointed by the governments of the IA-HEV member countries. This outlook is a synthesis of inputs from the IA-HEV Executive Committee members. IA-HEV functions within a framework created by the International Energy Agency (IEA). Views, findings and publications of IA-HEV do not necessarily represent the views or policies of the IEA Secretariat or of all its individual member countries.