

European strategic processes towards competitive, sustainable and user-friendly electrified road transport

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Summary

The European transport system will have to drastically change and adapt in order to respond to a multitude of societal challenges as well as to changing mobility needs. Reduction of CO₂ and other pollutant emissions, global competitiveness and use-centred approaches are major requirements to develop a sustainable and economically competitive European transport system. Electrified road transport has long been identified to be able to contribute strongly to all of the above mentioned. The present contribution reflects on the interplay strategies and processes that are followed by the European transport R&D&I community, public authorities and user-driven initiatives. The European transport R&D&I community including industry and academia as well as relevant related stakeholders addressed electrification of road transport as a means to tackle societal challenges but also in order to stay competitive in a rapidly changing international transport and mobility landscape. In particular, the European Technology Platforms ERTRAC (the European Road Transport Research Advisory Council), EPoSS (European Technology Platform for Smart Systems Integration) and the ETIP SNET (former SmartGrids) jointly drafted the European Roadmap on Electrification of Road Transport and initiate activities towards its implementation. The European Commission released a "European strategy for low emission mobility" in July 2016 with the aim to align the low carbon transportation system the Union is striving for with the increasing mobility needs of its citizens and the protection of the competitiveness of its industry. The development of the strategy is supported by several measures including the "Strategic Transport Research and Innovation Agenda" (STRIA) - a set of seven roadmaps dedicated to specific issues across all transport modes one of these being dedicated to electrification of transport in all modes. Furthermore, initiatives which focus on the user-perspective, as e.g. the CSA "Action Plan for the Future of Mobility in Europe" (Mobility4EU), beneficially bring in knowledge on how to plan the future transformation of the European mobility system in a comprehensive way. Conclusions are provided on the potential for innovation and disruption for joint initiatives of the three groups of players.

Keywords: mobility concepts, policy, strategy, user behaviour, demand

1 Introduction

Global trends and societal drivers are posing great challenges for the European transport system. Amongst others, urbanization requires new solutions e.g. to tackle (inner-city) congestions, and to reduce CO₂ and other pollutant emissions as well as noise. Changing lifestyles and especially digitization cause changing mobility behaviors and patterns and poses new demands on personalization of mobility options. In all these developments, social inclusion becomes an ever stronger obligation for all existing and novel transportation vehicles, systems and services. Last not least, the competitiveness of the European transport industry has to be secured at a global level.

These partly dramatic changes can only be efficiently tackled through continuous, rather revolutionary than evolutionary innovation and progress within the entire European transport system. Various novel and developing technologies from inside and outside the transport sector will push this process. Among them are digitization, big data, 3D printing, internet of things, robotics and artificial intelligence. However, revolutionary technologies oftentimes are not able to unfold their disruptive potential to change markets or society unless they combine with other solutions in a synergetic way and are met with appropriate user demand.

The European transport R&D&I community in an on-going joint effort has addressed electrification of road transport as a means to solve societal challenges and to move towards a sustainable transport system since almost a decade. Significant progress has been made in vehicle and battery technologies and energy efficiency of the electric powertrain. At the same time, public incentives have supported the market take-up of electric vehicles and the growing availability of charging infrastructure. This also led to an increased awareness of the public for electric vehicles.

Car manufacturers now invest massively to make electric vehicles an industrially viable and competitive product leading to noticeable changes in the automotive portfolio. Nevertheless, for electrification to be successful, electric vehicles must be embedded into the emerging novel transport system that will be much more characterized by its integration between modes and alignment along services. Hence, it has to be taken advantage of synergies of connectivity and automation in interplay with novel mobility offers and sharing concepts as well as other emerging technologies beyond the transport sector. Furthermore, user centered approaches have to be employed within the entire innovation process as well for product development and market implementation.

Important steps in this direction have been taken by the European Technology Platforms ERTRAC (the European Road Transport Research Advisory Council), EPoSS (European Technology Platform for Smart Systems Integration), and ETIP SNET (European Technology & Innovation Platforms Smart Networks for Energy Transition) who jointly published the 3rd edition of the European Roadmap on Electrification of Road Transport [1] and initiated activities towards its implementation.

Initiatives taking a user-centered approach as e.g. the Coordination and Support Action "Action Plan for the Future of Mobility in Europe" (Mobility4EU) [2] are currently supporting the process of designing a user-friendly transport system that benefits society, enhances social inclusion and is accepted by customers. Due to the mentioned benefits, such concepts include electrification as one major aspect, especially in the context of automation and sharing.

The European Union and Member States support the electrification of transport with dedicated policies and beneficial framework conditions. The European Commission in July 2016 released a "European strategy for low emission mobility" [3] with the aim to align the low carbon transportation system the Union is striving for with the increasing mobility needs of its citizens and the protection of the competitiveness of its industry. The development of the strategy is supported by several measures including the "Strategic Transport Research and Innovation Agenda" (STRIA) - a set of seven roadmaps dedicated to specific transversal issues across all transport modes one of these being dedicated to electrification of transport in all modes [4, 5].

In the following chapters these three groups of players (representing the complementing perspectives of companies, users and public authorities) and their current roadmapping and strategy development processes are being introduced. Conclusions on missing links, favorable next steps and new developments on the horizon are drawn.

2 European Roadmap on Electrification of Road Transport

The European Roadmap on the "Electrification of Road Transport", edited jointly by the European Technology Platforms ERTRAC, EPoSS and SETIP SNET (formerly SmartGrids platforms) was firstly published in 2009, and has been updated in 2012 and again now, in 2017. [1] It represents the commitment and shared vision of the industries involved in the European Green Cars / Vehicles Initiative PPPs and has been the base document for the European Commission's funding call topics on electric mobility since 2009.

It is also referred to as the source of research and innovation needs in the recently published STRIA roadmap “Electrification of the Transport System” [4, 5]. It takes into account major policy changes related to the EU Climate and Energy Framework, concerns about air quality as well as changes in the automotive value chains. Furthermore, the 2017 update sets a focus on user expectations and needs.

Analyzing what users actually expect from electric vehicles, the involved stakeholders found a quite diverse set of prospects ranging from competitiveness with conventional cars regarding cost, range, reliability, durability and re-sale value and comfort. Admitting that electric vehicles can hardly fulfil all these expectations at once, it was concluded that the “one vehicle fits all” paradigm needs to change and EVs will be designed rather for specific purposes and needs. At the same time the focus of the roadmap is enlarged from passenger cars to 2/3-wheelers, smaller (L-category) and larger (buses and trucks) vehicles.

The document provides dedicated roadmaps, indicating phases of R&I, demonstration, production and market introduction as well as the establishment of regulatory frameworks, for the electrification of the different vehicle categories along milestones on a timeline. A major achievement of the current update of the roadmap is the definition of a new milestone for 2030 entitled “Re-designed electrified road transport meeting the requirements of the future connected society”. The milestones already defined in the 2nd version are “Mass production of passenger cars and scaling-up of heavy duty vehicle electrification” for 2020 and “Fully revised electric vehicle concept” for 2025.

Also synergies of vehicle electrification with automation and connectivity are emphasized in the roadmaps, e.g. the energy efficiency gains due to automation that potentially increase the range. The exploitation of the full potential of electric vehicles including synergies that enable improvements in various technology fields (battery systems, energy demand, vehicle weight, software, sensor networks for automation and connectivity, etc.) is foreseen for 2025. The milestone for 2030 motivates synergy effects of automation, connectivity and electrification as well as new mobility models with specific purpose profiles. As automated driving will be integrated in our urban transportation scene, it could also trigger an electric car revolution. There are several reasons for that: e.g. electric vehicles are easier for computers to drive and there are a lot fewer crucial components in an electric car. Furthermore, with an overall change in transport behaviour (e.g. increasing percentage of car sharing usage), it will be easier, cheaper and safer to recharge a driverless car than to refuel it [6].

To implement these recommendations, four big R&I initiatives were developed (Fig. 1): Operation systems dependent EVs in the urban environment, user-friendly and affordable LEV/EV passenger cars and infrastructures, electric urban bus systems and sustainable electrified long-distance trucks and coaches. All roadmaps indicate phases of research and innovation, demonstration as well as the establishment of regulatory frameworks. Focus topics within these roadmaps include priorities regarding energy storage systems, drive train technologies, vehicle system integration, charging infrastructure as well as safety systems and the integration into the transport systems as a whole.

Further shaping of this roadmap and future updates will be supported through the EU funded Coordination and Support Action (CSA) “Future Research, Advanced Development and Implementation Activities for Road Transport” (Future Radar) [7]. This CSA supports the European Technology Platform ERTRAC and the European Green Vehicle Initiative (EGVI) PPP to create and implement the needed research and innovation strategies for a sustainable and competitive European road transport system addressing the key societal, environmental, economic and technological challenges. Hence, key topics include road transport safety, urban mobility, long distance freight transport, automated road transport, global competitiveness and all issues related to energy, environment and last not least user expectations.

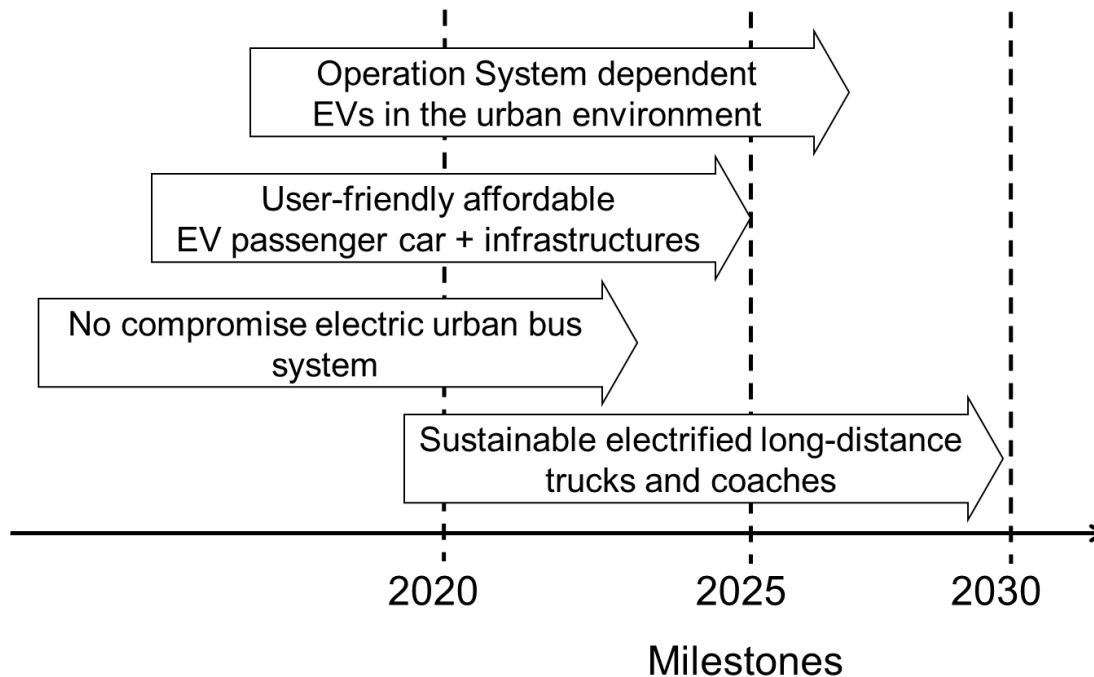


Figure 1: Four big initiatives for the electrification of road transport

3 Strategic Transport Research and Innovation Agenda and related public policies

In view of relevant policy frameworks for sustainable transportation such as the Transport White Paper [8] and the Energy Union Strategy [9], the European Commission in 2016 released the "European strategy for low emission mobility" [3] with the aim to align the low carbon transportation system the Union is striving for with the increasing mobility needs of its citizens and the protection of the competitiveness of its industry. The development of the strategy is supported among other measures through a "Strategic Transport Research and Innovation Agenda" (STRIA) [4] an integral part of the Europe on the Move package [5]. The STRIA consists of seven roadmaps dedicated to specific issues across all transport modes, one of which targets electrification.

Within the STRIA Roadmap "Electrification of the Transport System" all four transport modes are considered and it is aimed to align activities and generate synergies although electrification will be introduced at a highly different pace within the different modes. The individual targets and activities are – as in the other STRIA roadmaps – aligned on a timeline along milestones in 2020, 2030 and 2050. While rail transport is already widely electrified, waterborne transport will rely majorly on hybrid propulsion. Electrified airborne transport will probably be limited to ground operations or small short-range aircrafts. For urban road transport electric passenger cars, vans and buses are already mature while electrification for trucks and coaches still needs advances in research and innovation. Nevertheless, innovative technological developments as well as acquired skills from the road transport sector are expected to transfer into other modes and speed up developments there.

A further topic besides synergies and options for technology transfer are issues of electrification that are common to all transport modes. This applies to cost, energy density, power capability and lifetime of energy storage systems. Another issue across modes is the adaptation of the infrastructure to electrification. Infrastructures need to be reliable, affordable and ease-of-use regardless of the transport mode. Catenaries, static or dynamic, conductive or wireless charging, battery swapping or hydrogen tank filling are options discussed in various modes.

Public procurement supported e.g. through a revised Clean Vehicles Directive [10] as well as incentives for the private sector are recommended as a very effective tool for ramping up markets for electrified transport solutions. NO_x and particle emissions regulations are another powerful instrument to promote the electrification of buses and trucks, rail and maritime transport.

4 Towards user-centred transport in Europe

The CSA “Action Plan for the Future of Mobility in Europe” Mobility4EU [2, 11] is one initiative on EU level that focuses on multi-modality and user-centred transport. The project considers all transport modes and aims to include a broad stakeholder base thereby integrating other activities and initiatives emphasizing societal trends and drivers for transport and a human- and user-centered perspective on the R&D&I of transport technologies. Mobility4EU is working on delivering a vision for the European transport system in 2030 and an action plan including a roadmap to implement that vision.

The work towards that vision and action plan is based on the identification and assessment of societal trends and drivers and their impact on future transport demand and supply. This research on trends together with results from structured stakeholder discussions lead to insights regarding user needs on the future transport system. Among those are seamless end-to-end journeys, social inclusion, accessibility and affordability of offers, sustainable transport protecting environment and health as well as personalized offers and shared ownership models. Looking at solutions satisfying those user needs, the benefits that electrification of road transport can bring regarding sustainability of transport are evident. However, the combination of electrification with automation and sharing concepts provides synergies that answer user needs beyond sustainability toward a user-centered and multimodal transport system. Thus, solutions for urban freight and passenger transport, last mile connectivity and others can be propelled and enriched through bringing in electrification. This in turn may again lead to synergetic effects towards a more sustainable transport system. Within this beneficial circle also electrification is propelled towards greater market success.

Last not least, it should not be forgotten that electrification is not only a topic in road transport but also other modes as e.g. air and waterborne transport. The potentials of technology and knowledge transfer can advance solutions within the different modes and also create new innovation potential. Hence, electrification can not only be an activity of the actors of the road transport value chain but needs cooperation beyond the road transport industry and beyond transport industry itself. Most importantly the inclusion of not only end-users of passenger and freight transport, but also cities, service providers etc. is important in order to design new products and services that answer actual needs. Initiatives in this context make it ever clearer that to tap the full potential of transport innovations employing universal design is a prerequisite. To fulfill this, again collaboration with users is required but also expertise from social sciences and humanities can be brought in beneficially.

5 Conclusions

When the topic of electric vehicles was first put on the European R&I agenda almost ten years ago [12], the topic was met with mixed perspectives by the various stakeholder groups. While public authorities saw opportunities for tackling climate change and saving air quality, and released ambitious market development goals, perceptions remained ambivalent in the private sector: Supply industry, particularly from the electronics sector, seized the chance to claim leaderships in power train technologies, by then still a domain almost exclusively held by the OEMs, most of whom in turn remained quite hesitant. User needs were completely ignored, even though it was obvious that purchase preferences and mobility behavior would have to change significantly in order to achieve a high degree of market penetration of electric vehicles. As a result, the markets for electric vehicles failed to ramp up as quickly as projected.

The initiatives by industry, public authorities and users described in this paper clearly indicate that the situation has changed completely, in the meanwhile. Having established the European Green Cars Initiative, now the European Green Vehicles Initiative, public and private actors are now mostly aligned in their objectives regarding electric mobility. This is reflected in the cross references made between e.g. the ETP's and the STRIA roadmaps on electrification. Moreover, not least due to the Diesel emission scandal

users and citizens now raise their voice in favor of electric vehicles. The users' prospects and concerns are also increasingly well reflected in the strategies and roadmaps of the industry and public authorities. As has been shown in this paper, all stakeholder groups, industry and academia, policy makers and users now refer to the concept of a future vehicle that uses synergies of electrification with connectivity and automation, combined with shared usage and business models, that have been co-created with users. Such a future vehicle hence entails a full system that fulfills increasing mobility needs without causing more traffic and energy consumption. Therefore, it may have the potential to become a disruptive innovation that boosts the electric mobility market.

With more revolutionary innovation being imminent in the transport modes and at the transitions points between them, close cooperation of private and public sectors should further grow, and the participation of users should be considered already at the start of the design phase of new solutions. Therefore, it is high time for a European Transport and Mobility Forum that brings together users and industry for the development of new mobility solutions. Such an initiative is being worked on within the project Mobility4EU [2].

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