E-mobility

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Summary

Electric mobility (e-mobility) has emerged as one of the most promising technological solutions to replace fossil fuels, and has the potential to power most forms of personal and public transport. Local and regional authorities have a vital role to play in encouraging uptake: public procurement of e-mobility and the electrification of public transport infrastructure are areas of high potential. A range of public transport modes are ripe for electrification including buses, metro trains, trams and ferries. Regions can also help to create an enabling environment for citizens to switch to e-mobility solutions for personal use, including through investment in charging infrastructure, incentives and public-private partnerships.

Decarbonising transport

Transport is proving to be a roadblock to decarbonisation in Europe; unlike other sectors where greenhouse gas emissions have been trending downwards over a long period, transport emissions only started to decline in 2007, and still remain higher than 1990 levels. In 2014 greenhouse gas emissions from transport *increased* compared to the previous year. Overall, transport represents around a quarter of Europe's greenhouse gas emissions, with road vehicles accounting for more than 70% of this.

Transport emissions are also the main cause of air pollution, a growing societal and public health concern, especially in urban areas. The gravity of the effects on human health from transport related pollution is becoming clearer; it causes cancer, impairs lung and cognitive development, is implicated in psychiatric disorders in children, and stunts growth in the womb, making it, according to the BMJ (formerly the British Medical Journal), a ‘public health catastrophe’. Over half a million deaths each year in the EU are linked to air pollution, and the health impact of traffic fumes alone cost EUR 67 billion a year.

Electric mobility

A range of alternative energy sources are being explored to replace fossil fuels in transport, with two main solutions emerging; hydrogen fuel cell technologies, and electric vehicles. Hydrogen technologies are so far not as developed, though trials are ongoing and the technology may mature rapidly in coming years. This leaves e-mobility as currently the most promising technological solution. E-mobility refers to vehicles that use one or more electric motors for propulsion, being recharged externally, and primarily getting their energy from the power grid. Electric vehicles can be purely electricity powered, or combine an electric motor with a combustion engine (‘hybrids’).

Almost all of Europe’s current transport modes could be electrified; alongside electric cars, electric bikes and electric scooters are increasingly popular for personal travel. 80% of Europe’s trains are already electrified, and the electrification of other public transport modes such as buses and ferry boats is more and more common. Long haul and heavy duty travel are less well suited to e-mobility, however electric road systems for trucks are already being implemented in a number of EU Member States. For now it appears only air travel will remain reliant on liquid fuels.

Electric motors have several advantages over conventional combustion engines. This includes their higher efficiency (converting around 80% of energy to usable power, compared with 20% for a conventional vehicle), high durability and lower maintenance costs. In contrast to other

alternative fuels, such as biofuels, electric vehicles have zero tailpipe emissions and therefore do not contribute (directly) to air pollution. Due to their quiet operation they also create less noise and vibration, thus increasing comfort in urban areas.

The impact of e-mobility on emissions depends greatly on the source of the electricity - nuclear, fossil fuels or renewables. As renewables achieve higher shares in the energy mix, the greenhouse gas emission intensity of e-mobility will decrease. Even today, an electric car powered by the current European electricity mix generates 20-30% less carbon emissions over its lifespan compared to even the most efficient internal combustion engine vehicle on the market.

E-mobility can also offer new flexibility to the electricity grid. Innovative measures such as smart Vehicle-to-Grid (V2G) charging systems, mean locally produced renewable energy can be stored in the batteries of electric vehicles. Excess energy can then be fed back into the grid during periods of high demand.

EV Energy
Interreg Europe

Electric Vehicles for City Renewable Energy Supply

The EV Energy project is investigating how e-mobility interacts with the urban energy system. There are a number of ways that electric vehicles can be combined with, or exploited for, renewable energy services. These include: storage of electricity in EVs and/or electric public transport, EVs delivering energy to households or the grid, and energy back up services. EV Energy partners are analysing and developing policies that simultaneously promote e-mobility and renewable energy, focusing on the use of ICT for their intelligent integration. The project will create a framework for identifying effective policies related to electric mobility and renewable energy systems. This framework will be utilised to develop five Action Plans for e-mobility aware renewable energy systems in the participating regions Flevoland (The Netherlands), Catalonia (Spain), Stockholm (Sweden), Lithuania and Lazio (Italy). Inspiration will be drawn from innovative measures already being implemented in the regions, including the PowerParking system in Flevoland, in which large car parks become renewable energy plants with photovoltaics on the roof, connected with a smart grid to EV chargers and adjacent buildings.

Click here to visit the project website.

E-mobility barriers and challenges

Despite its great potential, actual deployment of e-mobility is still rather limited - electric vehicles (plug-in and battery electric) comprised only 1.5% of all new car registrations in the

EU28 in 2017, while fully electric buses account for only 9% of urban bus sales in Europe. To become a mainstream solution it must overcome a number of challenges:

- **Charging infrastructure** – Wide-scale uptake of electric vehicles is dependent on the creation of an adequate charging infrastructure. The current network is a patchy mix of public and private charging stations, with large discrepancies across Europe in terms of density and availability.
- **Range of motion** – Another of the main barriers for e-mobility to overcome is technical limitations in terms of battery size and range. This has so far prevented further expansion into long haul and heavy-duty transport. Battery technology is improving rapidly though, thanks to extensive research and development, which will make electric vehicles more efficient and user-friendly.
- **Cost** – Electric vehicles are still generally more expensive to purchase than conventional vehicles. This is prohibitive, even though electric vehicles are generally cheaper to run. Technological advances and wider market deployment will make electric vehicles increasingly cost competitive in the years to come.
- **Perception** – These and other factors have contributed to a mixed public perception of e-mobility. The positive arguments related to reducing emissions and health impacts have often been eclipsed by concerns relating to cost, battery range and general scepticism of a new technology.

European and national policies

In 2016, the European Commission published a European Strategy for Low-emission Mobility. This strategy reaffirmed the objective of reducing greenhouse gas emissions from transport by at least 60% by 2050, compared with 1990 levels. One of the main elements of the strategy is to speed up the deployment of low-emission alternative energies for transport (including electricity) and to remove obstacles to the electrification of transport.

The European Commission is in the process of passing a Clean Mobility Package of legislative measures, which includes a number of policies to support the transition to e-mobility. Under the Directive on Alternative Transport Infrastructure, member states must aim to build at least one public charging point for every ten electric vehicles on the road, and the directive will make it mandatory to use a common charging plug, to promote EU-wide interoperability. To support demand by users, the EU is working on improving customer information by reviewing the Car Labelling Directive, and is also promoting clean mobility solutions in public procurement tenders through the Clean Vehicles Directive. The recently passed Energy Performance of Buildings Directive also includes measures to promote e-mobility, such as provisions to ensure that buildings' car parks will be progressively equipped with recharging points. This applies to residential and non-residential buildings with more than ten parking spaces.

To accelerate the development of improved batteries, the Commission is investing EUR 200 million through the Horizon 2020 programme between 2018 and 2020. This will contribute to the more widespread use of electric vehicles, as well as strengthening Europe's industrial base. Regions have much to gain from the emerging electric vehicle market if they are able to become global frontrunners in manufacturing and research related to the sector.

Many national Governments have taken steps to directly incentivise e-mobility, including France, Germany and the Netherlands which have offered subsidies for the purchase of

electric vehicles, together with partial or full exemptions from registration tax, road tax, and/or company car tax.

Measures supporting e-mobility at regional level

Local and regional authorities have a vital role to play in the promotion of e-mobility, as well, and a number of measures and policy options are available.

Charging infrastructure (electricity)

There are many different partnerships and business models available for developing and expanding local charging networks. A number of companies are operating in Europe that give users access to their charging network for a fee; local authorities may choose to partner with one of these companies and co-sponsor the build-up of charging infrastructure. Offering subsidies or co-financing to local businesses or landowners to construct publicly accessible charging points on private land is also an option, or regional governments may also choose to provide grant funding for the construction of charging stations themselves. Depending on fee structures it is possible to generate revenue from these stations to offset this upfront investment. Regional authorities can also influence charging infrastructure by creating a unified payment system to simplify user access.

Seven conclusions from the EV Energy workshop on charging infrastructure

In April 2018, e-mobility and energy experts in Stockholm gathered for the EV Energy Regional Stakeholder Event, to share knowledge and experience about charging infrastructure initiatives and smart grid solutions across Europe. The most important conclusions from the meeting were:

1. **Increasing the number of public charging stations is a must –** As a rule of thumb regions should offer one public charging point per ten registered electric vehicles. The charging infrastructure has to be planned with regard to other uses of public spaces.
2. **User-friendly charging infrastructure –** Standardised and more user-friendly rules are required for parking and payment at public charging stations.
3. **Develop smart charging systems – Vehicle2Grid (V2G) –** This can balance irregular local production of electricity and also reduce grid imbalances in general.
4. **Co-ordination of efforts –** More test and demonstration projects are required for smart charging systems. Such efforts must comply with the real needs of users and energy providers. Coordination within a municipality and/or region is therefore recommended.
5. **Ensuring power grid capacity –** Early involvement of electricity companies in planning and construction of charging infrastructure is crucial for guaranteeing power supply.
6. **Customise regional and city planning –** E-mobility has to be better integrated into urban planning. As noise and emission levels from traffic decrease considerably, possibilities for housing projects arise in areas where it was previously restricted by law.
7. **Behaviour change is important for the transition towards e-mobility –** Electrification may give the user the experience of 100% sustainability, but in total the changes may lead to unwanted consequences depending on individual behaviours.

Click here to access the full article.

Incentives

A range of indirect incentives can be introduced by regional and local authorities to promote the use of e-mobility options by citizens. Many cities and regions have altered local traffic rules to create a preferential environment for electric vehicles. This could include free parking, use of bus lanes, or the creation of low emission zones with restricted access for polluting vehicles.

Awareness raising

As is common with new technologies, awareness and understanding of e-mobility is low among many citizens and local policy makers. Any policies to promote e-mobility should be accompanied by communication efforts to explain how e-mobility works, and its potential benefits for society.

Procurement

Public procurement can be a powerful market driver for the introduction of new technologies. This is no different for e-mobility. Many authorities are already looking at their own fleet of vehicles and making the transition to electric vehicles. A range of public transport modes are ripe for electrification including buses, metro trains, trams and ferries. A European Clean Bus Initiative has been set up specifically to help local authorities deploy electric and other low emission vehicles.

Public-private partnerships

Companies and start-ups are offering an ever increasing range of e-mobility services to citizens. This includes many transport sharing initiatives, as an alternative to private ownership, whereby customers pay for the use of a vehicle for a set time. Regional authorities can consider ways to encourage this activity in their territory, for example by entering public-private partnerships. Long standing car sharing schemes are transitioning to electric vehicles. Other car sharing schemes exclusively offer electric vehicles. In urban areas there is an increasing prevalence of electric bike, moped and scooter sharing schemes. These sharing schemes have great potential to be incorporated into a Mobility as a Service (MaaS) system, which integrates various forms of transport services into a single mobility service accessible on demand.

Regional strategies for e-mobility

The deployment of e-mobility solutions in a region requires co-operation between a wide cross-section of stakeholders, including public administrations, suppliers, parking operators, companies with transport fleets, private car owners, installers and suppliers of mobility services. For this reason, some regions have created a dedicated strategy for e-mobility, with a plan of how to engage and mobilise all of these stakeholders.

GOOD PRACTICE: Lazio Regional Plan for Electric Mobility (PRME)

Traffic in Rome is notorious, and this has a detrimental effect on air quality in the city. For this reason, Lazio Region is investing in a Regional Plan for Electric Mobility (PRME) as part of its Regional Mobility Strategy. Among other measures, the Plan foresees the development of an extensive charging network, and the introduction of tax breaks to promote the purchase of electric vehicles. Based on the estimated number of electric vehicles in the city in 2020, the plan has set a target number of public charging points to be developed. It supports private investments in the sector, defining rules for the construction and management of charging points. The Plan was prepared following a series of stakeholder workshops to facilitate consultation with local authorities and economic operators.

Download a presentation of the Plan.

Good Practices

Interreg Europe projects have been exploring how to boost uptake of e-mobility in their partner regions, and have identified many good practices that have shown success and are able to be replicated in other regions in Europe. A selection is provided below; for more, visit the Policy Learning Platform's Good Practice Database.

GOOD PRACTICE: Barcelona Electric Bus Opportunity Charging

The challenge for introducing electric buses relates to charging time and range. A bus on an urban route can be required to operate continuously for 16 hours; beyond the scope of current battery technologies. To solve this problem, Transports Metropolitans de Barcelona has implemented an Opportunity Charging strategy utilising innovative fast-charging batteries. The battery can be topped up in just 3 minutes at fast-charging points along the route, allowing vehicles to run more than 24 hours without returning to the depot. Seven buses currently use the technology, and Barcelona will acquire more than 100 more buses which are compatible with the system in the next three years.

Click here to find out more about this practice.

GOOD PRACTICE: The Castilla y León Electromobility Guide

As part of the Regional Strategy for Electric Vehicles in Castilla y León (Spain) an electro-mobility guide was produced to raise awareness amongst regional stakeholders. The guide is in two parts. The first is aimed at the general public and gives an introduction to e-mobility, describing how electric vehicles function and their advantages compared to conventional vehicles. The second part is aimed at educating local policy-makers, and includes examples of regulatory measures which can be implemented at the municipal level to promote e-mobility. Public presentations were given to promote the guide, with municipalities expressing an interest in installing charging infrastructure and introducing measures to promote e-mobility, such as tax reductions, access to bus lanes, and reduced vehicle licence fees.

Click here to find out more about this practice or here to download the Castilla y León Electromobility Guide

GOOD PRACTICE: Amsterdam's demand-driven charging infrastructure

The widespread uptake of electric vehicles is reliant on the rollout of charging infrastructure. Amsterdam is taking a demand-driven approach, responding to requests from electric vehicle users for infrastructure installation where existing charging stations do not exist, or where they are being used more than 50% of the time. This approach ensures that resources are efficiently used to install charging infrastructure only where it is needed, whilst also giving confidence to individuals that they can invest in an electric vehicle and have access to charging points. The full process, from online application to installation takes two months, and applications are assessed based on distance to the nearest existing or planned charging point, and how many individuals are using the existing infrastructure. By 2018, Amsterdam had installed more than 3,800 charging points and the model is being replicated in cities across the Netherlands, including Almere, Haarlem, Amstelveen and Zaanstad.

Click here to find out more about this practice.

GOOD PRACTICE: PIRVEC - Strategic Plan for the deployment of charging infrastructure for electric vehicles in Catalonia

In Catalonia charging infrastructure was mostly concentrated in the metropolitan area of Barcelona, making it a challenge to move around the greater Catalonia region by electric vehicle. To remedy this, the Government of Catalonia launched the Plan for the deployment of charging infrastructure for electric vehicles in Catalonia (PIRVEC). As part of the plan the regional government will allocate EUR 5.8 million to set up 100 quick charging points on the public road network; 400 new stations for semi-fast charging in urban areas and leisure centres; 25,000 new charging points in areas such as private community car parks, which will receive subsidies covering up to 50% of installation costs; and a unified identification and payment system, accessible through smartphones, for easier access to the EV charging network. The plan does not initially foresee the involvement of the private sector, therefore infrastructure must be developed by city councils. Recognising the importance of e-mobility, the city councils have embraced the plan and together will help achieve the objective of creating fast charging every 50 km by the end of 2018, guaranteeing the connection between the metropolitan areas of Barcelona, Girona, Tarragona and Lleida and access to Central Catalonia, Terres de l'Ebre and Pyrenees.

Click here to find out more about this practice.

Recommendations

- Given the expected importance of e-mobility in the future transport mix, authorities should make e-mobility a key feature in any Regional mobility plan, or, as in the Lazio region, consider developing a dedicated Regional e-mobility strategy.
- Stakeholder involvement is vital and should involve all relevant actors, not only in transport and environment management, but also representatives from industry and research;
- Given the importance of tackling problems related to emissions, other measures will be needed whilst e-mobility (and other solutions) develop, including air filtering technologies for cars and buildings. To this end, strategies should link to overall long-term regional development, low carbon, air quality and smart specialisation strategies;
- Increasing the number of public charging stations is a pre-requisite for personal e-mobility. As a rule of thumb, regions should offer one public charging point per ten registered electric vehicles. The EV Energy project's recommendations can provide guidance;
- Shared mobility solutions should be promoted due to their added potential to reduce congestion and pollution. Public and private sharing schemes for electric cars, bikes and scooters are increasingly common;

- As shown in the EV Energy project, authorities should carefully study the impact of e-mobility on the electricity grid. Close co-operation with electricity suppliers, as well as the deployment innovative technologies such as Vehicle2Grid charging, can help ensure security of supply;
- Indirect incentives for electric vehicles – for example bus lane access, or free parking – can be cost-effective measures to promote e-mobility;
- Public authorities can lead the way with e-mobility through the procurement of electric vehicles, including for public transport, as with Barcelona's electric buses;
- Authorities should consider partnerships with private companies to complement other measures on e-mobility. Many start-ups and companies are offering services such as vehicle charging or sharing schemes, which can accelerate the uptake of e-mobility in regions.
- Citizens are central to the transition to e-mobility. As in Castilla y Leon, awareness raising activities are therefore needed to press home the benefits of e-mobility, and to educate about some of the practicalities of engaging with this new technology.

Sources, further information

- Committee of the Regions – Electromobility Guide for Local and Regional Authorities (2015)
- European Commission – Clean Power for Transport: A European alternative fuels strategy (2013)
- European Commission – State of the Art on Alternative Fuels Transport Systems in the European Union (2015)
- European Commission – A European Strategy for Low-Emission Mobility (2016)
- European Environment Agency – Electric vehicles from life cycle and circular economy perspectives (2018)
- European Parliament - Charging infrastructure for electric road vehicles (2018)
- European Political Strategy Centre – Towards Low-Emission Mobility (2016)

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