FAQ - Frequently Asked Questions
Electro-mobility

The Platform for Electro-mobility is a multi-stakeholder organisation calling for sustainable, multimodal transport system in which people and goods are predominantly moved across land in Europe using sustainable electricity. The aim of the Platform is to drive the development, implementation and support for sustainable European Union policies, programmes and initiatives to move people and goods by electro-mobility.

This FAQ intends to provide fact-based information about electro-mobility, across all modes of transport. It is a referenced document that aims at improving knowledge of electro-mobility in general, while dismissing myths and false facts. It does not reflect any member's view in particular. The FAQ constitutes a unique toolkit for people keen on learning more about the transition to e-mobility.

1. Electro-mobility as a strategic choice

Q: What share will electro-mobility take in the upcoming years?

A: The future market will depend upon the development of the ecosystem but there are already some encouraging signs, both from the public and private sectors. Many cities, regions and countries are developing plans to enhance the development of the electromobility eco-system through incentives, infrastructure and change of fleets. Besides tramways and metro systems, electric buses are now being introduced on the market to provide zero-emission public transport. In the automotive sector, electromobility is at the heart of many manufacturers' strategy: Volkswagen aim to sell 20-25% electric cars by 2025; Nissan is targeting 20% of European sales to be electric by 2020.
Fostering the electrification and upgrade of railway lines, including regional connections, is also a strategic medium-term objective of several Member States.

Q: Do EV only serve to meet targets and escape penalties for OEMs?

A: EVs are moving mainstream. EV is a strategic choice for all manufacturers, with enormous investments in R&D. For instance, since 2009 Renault-Nissan has invested more than 4 billion for the deployment of electro-mobility. This business choice is mirrored, even if still too partially, by many public authorities' investments in infrastructure, as well as through in-use and fiscal incentives. This joint commitment of both industry and authorities is a clear sign that electro-mobility is far more than just a "patch" used by car manufacturers in order to comply with regulatory requirements. More generally, there is a business case for electro-mobility as recent important investments in electro-mobility show; e.g. Bmw, Daimler, Ford, and VW with Audi and

Porsche plan a joint venture for ultra-fast charging (350kW).

Q: What are the possible incentives for the further development of rail electrification?

A: There are different solutions that can be identified – from the regulatory, economic and technological point of view – in order to bring further the electrification of rail transport. The industry is committed to develop, through R&D projects such as Shift2Rail, innovative energy efficient solutions for both urban and main line transport. Moreover, correcting the counterproductive policies for using electricity (taxation) and creating a regulatory framework which enables public transport operators to reuse recovered energy in the most efficient way (resell it to the grid as renewable energy), could lead to substantial transport decarbonisation and electricity decarbonisation.

Q: Is the range of EVs adapted to consumer needs? Isn't it too limited?

A: Today, most of the individual car journeys are home/work commuting, with an occupancy rate of a bit more than 1 and a distance of less than 80 km. The EV is a perfect solution for these kinds of needs. BEVs have been improving their range over the past years, for light personal vehicles (Renault Zoe, Nissan Leaf, Chevrolet Bolt, Opel Ampera…) and small vans (e.g. Renault Kangoo). Several battery electric vehicles on the market already demonstrate a "real-driving conditions" autonomy of 300km or above.

Q: Are charging infrastructure for EVs limiting the possibilities of long journeys?

A: There already are about 100 000 charging stations across the EU-28 member states [1], which is not a scarce number! New charging points continue to be installed and this number will continue to accelerate as the countries are being asked by the AFI directive to set up a deployment plan of alternative fuels infrastructure.

Germany plans by 2020 is to have 36,000 normal charging points and 7,000 fast charging points over the country. In France, the Environment minister announced following target on 1 October 2016: 1 million EV charging points within three years, of which 900,000 at private residences and 100,000 open to the public.

Companies like for example RWE, Eon or EDF created dedicated company divisions or subsidiaries for electromobility in order to match the demand of charging infrastructure.

2. Carbon footprint of electric vehicles

Q: What is the real performance of zero emission vehicles on a life-cycle basis?

A: On a life-cycle basis, EVs are already very competitive regarding CO^2 emissions (compared to other propulsion modes). This CO^2 intensity will further decrease in the future, based on the increasing share of renewables in the energy mix.

[1] Number of charging points as per February 22, 2017: 99 647 in the EU 28. Source: http://www.eafo.eu/electric-vehicle-charging-infrastructure

With the average carbon intensity of the power sector (based on the EU28 energy mix in 2010), electric vehicles emit less GHG than their internal combustion equivalents: 78g WTW compared to 105g for PHEVs and 185g for Gasoline engines.[2] Most GHG emissions in WTW calculations occur during the use phase. The European Commission JRC's report on Green Public Procurements highlights that EVs Life cycle costs are already now lower than ICE's one, and that this is expected to improve as the energy mix gets cleaner.[3] (see JRC report, table 37). BEV are assumed to score best in 2030 with an expected reduction of lifecycle GHG emissions of 50% between 2012 and 2030. During the vehicle production, the battery used in PHEVs and BEVs is the most critical component in terms of GHG emissions contributing 30-50% of total emissions, mainly due to the materials and quantities required for the battery production. Also, since batteries are increasingly getting re-used for energy storage purposes, their overall GHG emissions will further decrease over their lifetime.

Q: Won't a massive market uptake of EVs only shift CO2 emissions from the vehicle use to the energy generation?

A: The well-to-wheel CO2 emissions of the EVs in Europe (specifically the Renault ZOE) are expected to be more than halved between now and 2030, dropping from 72 to 24.5 grams of CO2 per km, according to the scenario limiting the global temperature rise to no more than 2°C by 2100. This scenario is based on decarbonising the energy system by using renewable energy.

Even in countries with high amounts of coal generation, such as China, electric vehicles already have lower WTW CO2 emissions per mile driven than the average ICE vehicle. When considering the possible improvements in internal combustion engine technology, it appears that electric vehicles will still have lower CO2 emissions per mile by 2030. Moreover, this differential will increase after 2023 as the share of renewable power generation grows faster than ICE engines can improve. This means that the carbon footprint of EVs will improve over time, and not get worse.[4]

For France, an UFE study on the evolution of energy demand identifies the roll-out of electric/hybrid vehicles as the most climate-effective action over more than 50 actions in all sectors of the economy, thus proving the need to enhance e-mobility so as to reach the objectives set in the Paris agreement.

3. Energy mix of the countries

Q: Member States have very different energy mix across Europe. As the situation of energy mix is fragmented, is it always environmentally friendly to drive an EV in all EU countries?

A: With the current European average power mix and its emissions of 275.9g CO2/

[2] DG MOVE/ Cowi 2015 study "State of the Art on Alternative Fuels Transport Systems."
[3] http://susproc.jrc.ec.europa.eu/Transport/docs/EU_GPP_Transport_Preliminary_report.pdf
[4] Bloomberg&McKinsey: The Future of mobility, 2016

KWh, electric vehicles emit less than 50% of what an average internal combustion engine car emits today.[5] The WTW emissions of EVs will continue to fall, as the European power sector will decarbonise by 2050. Also, WTW CO2 emissions of EVs in 2015 were estimated by the JRC at 78g CO2 equivalent compared to 185g for conventional gasoline and 145g for conventional diesel engines.[6]
In 2014, the share of electricity generated from renewable sources is growing rapidly and reached more than one quarter of all gross electricity generation in the EU-28 (29 % in 2014). Eurelectric projects that in 2030, 80% of European electricity will be carbon free (half from renewable and half from nuclear electricity generation).[7]
Moreover, countries where the electricity carbon content is the lowest (such as France and Norway) are currently frontrunners on e-mobility.

Q: What is the share of renewable energy sources in the electricity mix?

A: Overall, more than 70% of the capacity installed in 2013 came from renewables (mostly wind and solar). In 2013, approx. 27% of the electricity produced came from renewable energy sources (RES) in the EU28.[8] By 2040, 50% of European electricity will come from renewables.[9]

4. Carbon footprint: Battery and life cycle

Q: Is the maintenance of an EV as expensive as for an ICE car?

A: Element energy study on Total Cost of Ownership (TCO)[10]: all powertrains (except H2 fuel cells) on average have lower ownership costs in 2030 compared with petrol ICEs in 2015, despite a backdrop of rising fuel and electricity prices. BEVs reach near TCO purchase price parity with diesel ICEs -the cheapest powertrain- for the first owner in 2030. Over the life of the vehicle, the TCO of BEVs falls significantly below conventional vehicles, even after the acquisition price of home charging points is included.

5. Battery 2nd life and recycling

Q: What can be done once a battery is used?

A: 2nd life of EV batteries as energy storage units to power buildings or renewable energy facilities can double the lifetime of a EV battery from 8-10 years to 16-20 years. The Renault-Nissan ELSA project, which is funded under Horizon 2020, develops

[5] See the below-mentioned JRC estimates.
[6] DG MOVE/ Cowi 2015 study "State of the Art on Alternative Fuels Transport Systems"
[7] In: DG MOVE/ Cowi 2015 study "State of the Art on Alternative Fuels Transport Systems"; p.16.
[8] DG MOVE/ Cowi 2015 study "State of the Art on Alternative Fuels Transport Systems"
[9] International Energy Agency (IEA) World Energy Outlook 2015: https://www.iea.org/publications/freepublications/publication/WEO2015SpecialReportonEnergyandClimateChange.pdf
[10] http://www.beuc.eu/publications/beuc-x-2016-121_low_carbon_cars_in_the_2020s-report.pdf

distributed storage solutions to maturity by combining 2nd life batteries with an innovative local ICT-based energy management system. ELSA storage systems is applied in six demonstration sites representing several application contexts.. BMW has also launched a couple of initiatives to give a second life to used battery packs from its electric vehicles. Together with Bosch and Vattenfall, the German automaker announced a wall mounted battery storage system, not unlike the Tesla Powerwall, using BMW i3 22 kWh or 33kWh battery packs.
The emergence of recycling sector will follow the massification of the EV market. Currently, technological solutions already exist to recycle critical material of batteries such as lithium/ manganese/ cobalt but there is no viable business case yet as there is no sufficient supply.

6. Affordability

Q: How affordable are electric vehicles?

A: The purchasing price of today's best-selling EV models (Renault ZOE, Nissan LEAF) is still slightly higher than their equivalent ICEs models indeed. However, costs will come down together with the massification of the market, the related economies of scale and the progresses in batteries technology – in fact, some car manufacturers already announced that EVs purchase price will be the same as their ICE equivalent by 2020, which means EVS' TCO will be lower as of day 1. For instance, the new Renault ZOE which was launched in 2016, has doubled its range compared to the previous version for only a very minor price increase. To that, you have to add the fact that refueling and maintenance costs of BEVs are incomparably lower than those of the ICEs. The recent Element Energy study commissioned by BEUC[11] demonstrates that "by 2024 the average 4-year cost of running an electric vehicle should match that of a petrol car".
The sales price of an electric bus is estimated today to be about twice the price of a classical diesel bus. However, this reflects today a situation where in Europe only limited demonstrations or deployments have been made, so no manufacturer has reached any sort of economies of scale. With now more significant investments being made, for example in the Netherlands, one can expect the TCO of electric buses to come closer to their diesel equivalent.

Q: Can EVs be used to save money?

A: Connected to residential power supply or renewable energy sources such as solar panels, a vehicle to grid (V2G) unit can save customers money on their utility bills by charging up when renewable energy is available or energy is cheaper (e.g. during the night) and releasing that stored energy when demand and costs are high. This is an innovative solution that can help consumers manage their energy use more efficiently

[11] http://www.beuc.eu/publications/beuc-x-2016-122_low_carbon_cars_in_the_2020s-brochure.pdf

while saving them money.

7. Impact on jobs

Q: Will a switch to electro-mobility harm manufacturing jobs across Europe?

A: According to an ECF study[12], between 501,000 and 1.1 million net additional jobs could be generated by 2030. In 2050, this rises to between 1.4 million and 2.3 million additional jobs, even when the jobs lost during this transition are taken into account. Most of the new jobs are created outside the automotive value chain, in sectors such as services and construction, which benefit from the shift in spending away from the fossil fuel value chain and towards domestically-produced goods and services, thus ensuring Europe remains competitive.

The railway supply industry, which predominantly focuses on electric vehicles, represents 400.000 jobs in Europe. It is today a world leading sector with a 46% market share worldwide. The need for high-capacity, zero-emission public transport in many cities across the globe provides a significant growth opportunity for the sector.

Q: Where do European auto-manufacturers produce their cars?

A: The production of Nissan EVs (LEAF, eNV200) and Renault EVs (ZOE, Kangoo Z.E., Twizy) and EV battery production, all produced in Europe is a significant contributor to the European manufacturing base and jobs.

Daimler has already announced it will produce its new electric vehicles in their existing German plants by integrating them with serial production of cars with combustion engines. Volkswagen will begin the production of the ID in 2019 in Germany as well (in Zwickau, Saxony). Once the market for electromobility really takes off in Europe, manufacturers will have an incentive to produce electric cars locally, near the market where they sell their products.

Europe already has an existing strong battery production base of different battery technologies (lead, lithium, sodium and nickel batteries), and the industry operates 16 R&D centres in Europe. However, the majority of EVs battery cells is not produced in Europe for the moment. China, Japan, and Korea are leading the market, but with expected growing demand for electric vehicles, the development of a European EV battery cell production is likely, especially since shipping big quantities of batteries would be both costly and dangerous (according to VW's head of corporate strategy Sedran)[13]. Even when battery cells are shipped, assembling of pack and modules and integration with the vehicle usually take place in Europe.

Also LG Chem announced a new production facility in Wroclaw, Poland: The new facility, which LG Chem will be investing around 1.3 billion złoty ($340 million) into, will cover all

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[12] Fueling Europe's Future:https://europeanclimate.org/wp-content/uploads/2014/03/FEF_Final.pdf

[13] http://europe.autonews.com/article/20170102/ANE/161219895/automakers-hunt-for-battery-cell-capacity-to-deliver-on-bullish-ev

aspects of battery production (from electrode to cell to modules and battery packs). Likewise, Samsung announced a new plant for the second half of 2018 north of Budapest, Hungary.
However, public and private investments to keep and develop the production of different battery technologies in Europe will be paramount for the competitiveness of different EU industrial sectors and for the creation of jobs and growth in Europe.

8. Spin-off effects of electro-mobility

Q: What are the benefits of electrification in terms of reduction of polluting emissions (fine particles, NOx)?

A: Electric vehicles produce no tailpipe emissions, meaning no CO2, nor fine particles or NOx. Beyond decarbonization, EVs have therefore a key role to play in improving air quality, particularly in cities. Surveys in Rome and Hong Kong suggest that by 2020, with EVs accounting for just 20% of city centre traffic, the concentrations of nitrogen dioxide can be reduced by as much as 45%.
Trains running on electrified lines emit on average 20 per cent to 30 per cent less carbon dioxide than diesel trains

Q: Can health benefits really be linked to the boosting of transport electrification?

A: ECF a study dedicated to the UK found that [14]CO2 emissions from the car and van fleet could be cut by 47% by 2030, and as much as 80% in 2050. Reductions of air pollutants, such as nitrogen oxides and particulates, would help lower the incidence of respiratory diseases. The health benefits associated with these air-quality improvements are estimated to be worth £1 billion to £1.2 billion to the UK economy.

Q: Will electrification of transport really have an impact on reducing the noise in cities?

A: The World Health Organisation has acknowledged in a 2011 study that noise in cities is a public health problem.[15]According to this study, 1.8% of heart attacks in high income European countries are attributed to traffic noise levels higher than 60dB. A 2008 study by Transport & Environment and CE Delft estimates at 50,000 the number of noise-related fatal heart attacks in Europe per year.[16]
Electric vehicles and electric trains can improve the situation. Even if at constant speed (e.g. 50 km/h) electric vehicles do not emit less noise than an ICE (ca. 70 dB), EVs do make a difference (between 2 and 5 dB less) at a speed lower than 30km/h and an even more significant impact when the vehicle does not move at all.[17]
Electric railway lines mean that trains with heavy diesel engines are not needed. Trains

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[14] http://www.camecon.com/wp-content/uploads/2016/10/Fuelling_Britains_Future.pdf
[15] World Health Organization press release and report available at http://www.euro.who.int/__data/assets/pdf_file/0008/136466/Burden_of_disease.pdf
[16] https://www.transportenvironment.org/sites/te/files/media/2008-02_traffic_noise_can_you_hear_us.pdf
[17] https://www.toi.no/getfile.php/mmarkiv/Forside%202015/compett-foredrag/Lykke%20-Silent%20Urban%20Driving.pdf

don't need to carry their own fuel making them lighter than diesel trains. The journeys on electric trains will be faster and quieter, decreasing substantially the noise pollution especially in densely populated areas.

Q: Will EV uptake result in a decrease in tax revenues?

A: Tax revenues in Member States are expected to go down as more electric vehicles are sold on the market. This loss will however be offset by the positive externalities of electromobility, for instance on air quality, noise, and public health.

9. Impact of EV on the power system

Q: Can Europe generate enough electricity to charge all those electric vehicles?

A: Due to the high efficiency of electric motors and the incremental take-up of electric vehicles, the electricity demand won't rise overnight. If 10% of the cars in Europe were electric, this would mean a modest rise in electricity demand of 2-3%.

But given the fact that some generation assets currently stand idle and given the flexibility of EVs when it comes to charging, the current power system would be able to provide enough electricity to charge 100% of cars in the EU.

Q: Will EVs endanger the electric grid once they become widely used, as the distribution grid is not equipped to support such a demand in electricity?

A: The current number of EVs on Europe's road does not pose a problem to the electricity system. With view on high EV shares in the future, it is important to address the question how an electric vehicle will be charged. The average car in Europe is parked for around 95% of its lifetime. If the car is plugged in during most of this time (e.g. at home and at work of the EV driver), then there is a huge potential for smart charging. Smart charging of an EV is when the charging cycle can be altered by external events, be it price or load signals, providing the EV with the ability to integrate into the whole power system in a grid- and user-friendly way.

Uncontrolled charging, however, could indeed cause some problems: A EURELECTRIC study found that if all cars in Europe were electric and charged in an uncontrolled manner, this could increase the European peak load by around 21% (130GW).[18] The same study has found that in the case of smart charging, the peak load can be held stable, while improving the utilisation of the electricity grid.

Moreover, the "My Electric Avenue" research project[19] carried out by Ofgem, the British energy regulator, showed that no significant grid reinforcement would be needed before 40% to 70% of existing cars were replaced by EVs. Above that level, smart charging, i.e.

[18] EURELECTRIC: Smart charging: Steering the charge, driving the change, March 2015. For the calculation of these numbers it was assumed that the additional load is uniformly spread across the load curve. The percentage was calculated based on the expected peak load in 2035.

[19] http://myelectricavenue.info/

coordinating the charging of electric vehicles to avoid sudden surge in electricity demand, would greatly limit the need to reinforce grids.

Q: But what about fast chargers? Here, drivers want to charge their car as quickly as, so there is no room for this smart charging.

A: Public fast-charging stations don't impact the grid much because they are part of commercial grids that have transformers and other equipment sized to accommodate large loads.
If the load at a fast charger is become a problem for the grid, stationary batteries can be used to mitigate the impact. This is currently done in Oslo, where Fortum is building an innovative charging facility with more than 100 charging stations at a car parking garage. The batteries are constantly and slowly charged – during peak demand, the the batteries charge the cars. Other examples for this technology can be found in Austria, Germany, France or Italy. However, fast charging will always be more expansive than normal power charging, because fast charging is requiring much more grid capacity. In daily life, people will mostly use their normal power chargers at home and at work, but for long distance journeys, fast chargers are important to complement the charging opportunities.

Q: Can an EV really serve as energy storage and what is the impact on the grid?
A: Electric vehicles can play a role in the electricity grid. Smart charging and price incentives allow to moderate the impact of EV on the grid, allowing for flexibility services such as so-called valley filling, peak shaving, and most importantly ancillary services.

Q: What does smart charging mean for EV drivers?

A: As long as charging mainly happens via a cable, EV drivers would only need to plug In their car while parked, and potentially programming the smart charging with a time when a certain charging state should be reached. The benefit of smart charging can be lower electricity bills for customers (as the car is charged when prices are low) and more flexibility for the electricity system, using the EV batteries as a resource for system flexibility.

10. Raw material sourcing in battery production

Q: EVs batteries contain lithium and rare earths, which are limited resources and extracted in developing countries?
A: According to the New Zealand Energy Efficiency and Conservation Authority, electric vehicles do not use much of the so-called "rare-earth" metals in their manufacture. If it's true that EVs use a certain amount of rare-earths (e.g. neodymium in the electromagnets of their drivetrains), the resource depletion impact associated with these components is negligible. And contrary to another popular misconception, the lithium used in PEV batteries (in the form of salts) is neither a rare-earth, a precious nor even a particularly

scarce metal. Lithium was found to contribute less than 1% of the resource depletion impact for electric vehicles.[20]

Q: Can the lithium contained in the EV batteries be recycled?

A: One form of recycling is to repurpose the battery for a different application that can benefit from the amount of energy still available in the battery. Having such a second life use is the most economical form of recycling. Once a lithium-ion battery is completely dead however, it has to be recycled in a dedicated facility. Recycling of all the battery components already takes place, even if this is a cumbersome procedure.

Q: Do battery producers/ car manufacturers take part in initiatives ensuring the origin of raw material used for battery production?

A: Several car manufacturers take part in the Conflict free sourcing initiative, such as Fiat Chrysler, Ford, General Motors, Toyota, Volkswagen America, Tesla.
Major battery producers are also part of the initiative, like LG Chem, Panasonic, Bosch, Samsung.

Q: Do we need batteries?

A: railway line electrification is made through catenaries and pantographs, i.e there is a permanent contact between the train and the grid, so no need for batteries.
In the tramway and bus sectors, several electrification technologies use “opportunity charging”, i.e the vehicle recharges its batteries during its journey. That limits the volume of on-board batteries and enables a longer autonomy.
Several research projects investigate whether similar technologies could be deployed for the electrification of road freight transport.

[20] http://apo.org.au/files/Resource/ev-lca-final-report-nov-2015.pdf