

Electrify
PARIS



**HOW TO IMPROVE THE PARIS ELECTRIC VEHICLES
POLICY?**

INTRODUCTION

After having achieved a certain level of economic stability, the concern for developed economies, has moved towards conserving the environment and reducing the overall social costs. One of the key transitions that has been observed is the shift in the transport/ locomotive industry with more and more governments and citizens becoming aware about the environmental impacts and social costs they are incurring by using fuel driven or gas driven vehicles. Many countries have begun to adopt the usage of Electric Vehicles and have also been heavily promoting the same through government incentives. Since 2013, the overall registrations of electric vehicles have been increasing continuously around the world.

The use of electric vehicles could be interesting in Paris and its suburbs, because the usage of the car in this area is considerable. Indeed 74% of Francilien people use their car daily to go to work and the duration of their journeys is much longer than in the rest of the country (more than one hour in average)¹. To fight the related pollution, the Mayor of Paris Anne Hidalgo has aimed to ban the use of oil car in Paris by 2030 or 2040². However, this goal seems unachievable without good policies to promote alternative solutions, as electric vehicles, which can be an excellent alternative to oil cars.

Moreover as of now electric vehicles cannot fully be used in the whole country as there are still some important limits in terms of autonomy and infrastructures. However, the more people will switch to electric vehicles, the more businessmen and collectivities will invest in this technology and, as a direct consequence, the more new consumers will be convinced to be adopters: it is indeed, a virtuous circle.

Therefore it is a good idea to begin implementing policies within the capital: there are less infrastructures limits than in relation to the whole country and, if successful, the city's policies can also serve as model for other capitals. In this context there are nevertheless some obstacles to the development and the massive adoption of electric vehicles in Paris and in the rest of the area. This is why we have decided to address this problem, to

1 Fanny Lechevestrier, 2015. "Les Franciliens, champions du temps de trajet domicile-travail avec 68 minutes en moyenne". *France Bleu*. <https://www.francebleu.fr/infos/transports/les-franciliens-champions-du-temps-de-trajet-domicile-travail-avec-68-minutes-en-moyenne-1446489301>.

2 Hayate Gazzane & Angelique Negroni, 2017. "Paris envisage aussi la disparition des voitures à essence d'ici à 2030". *Le Figaro*. <http://www.lefigaro.fr/conjoncture/2017/10/12/20002-20171012ARTFIG00080-paris-envisage-d-interdire-toutes-les-voitures-d-ici-2030.php>.

analyse what has already been set up in Paris, and to try to suggest improvements for Paris electric vehicles policy.

EXECUTIVE PLAN

In order to come up with a grounded proposition on promoting electric vehicles in Paris, it is crucial for us to be fully aware of and understand the current context of electric vehicles in the capital of France. Therefore, we will start by summarizing the actions that have been taken so far in Paris to incent the popularization of electric vehicles. We will also shed the light on the active players in Paris in the industry.

Secondly for purpose of improving the actual Paris policy, we will present case studies of other cities in Europe and other countries where electric cars policies have been successful. Finally, we will conclude with recommendations to improve the current policy.

I. PARIS CONTEXT

(1) Existing policy in Paris for global incentives³

The number of sold electric vehicles is in huge growth in France (+ 24% between 2016 and 2017⁴). At the beginning of 2017 around 100 000 electric cars were used by individuals⁵ with a bit more than 20 000 plugging stations spread on the territory⁶.

In this context Paris officials confirmed their intentions to ban all cars run on gasoline by 2030. According to Christophe Najdovski, deputy mayor of Paris, they seek to establish a "carbon-neutral" city, that is to say, to reduce greenhouse gas emissions on the long-term⁷. Especially since 25 percent of current atmospheric pressure in Paris comes from traffic pollution, introducing electric vehicles has been considered one of the solutions to mitigating the effects of air pollution. The problem is that between 2010 and 2017, there were only 27,000 electric vehicles registered in the Île-de-France region, due to several reasons including the lack of promotion as well as lack of available charging stations.

Indeed the emphasis in Paris has been put on shared vehicles. One of the most known initiatives is the Autolib network, a network of shared electric vehicles. According to the Paris website, there are currently 1100 Autolib stations in the Ile de France area. The municipality has also tested a service of commercial vehicles sharing in the second arrondissement. However, the issue with car sharing services is that not everyone can use it at the same moment, therefore it is far from replacing property. Moreover, while Autolib was introduced as the first public electric car rental service available in France since December 2011, its vehicles only have a power of 3KW and need to stay connected between six and eight hours in order to fully recharge their battery.

³ Parisfr, 2017. "Véhicules électriques". *Paris.fr*. <https://www.paris.fr/services-et-infos-pratiques/deplacements-et-stationnement/deplacements/vehicules-electriques-2776>.

⁴ Avere France, 2017. "En novembre, les ventes de véhicules électriques frôlent les +24% de hausse". *Avere-france.org*. http://www.aver-france.org/Site/Article/?article_id=7164&from_espace_adherent=0.

⁵ Christophe, Bourroux, 2017. "100.000 véhicules électriques immatriculés en France". *Rtl.fr*. <http://www.rtl.fr/actu/conso/100-000-vehicules-electriques-immatriculés-en-france-7787800260>.

⁶ Jean-Baptiste Giraud, 2017. "Voiture Electrique : plus de 20.000 bornes de recharge en France". *Turbo.fr*. <http://www.turbo.fr/actualite-automobile/836196-voiture-electrique-20-000-bornes-recharge-france/>

⁷ Hayate Gazzane & Angelique Negroni, 2017. "Paris envisage aussi la disparition des voitures à essence d'ici à 2030". *Le Figaro*. <http://www.lefigaro.fr/conjoncture/2017/10/12/20002-20171012ARTFIG00080-paris-envisage-d-interdire-toutes-les-voitures-d-ici-2030.php>. <http://www.20minutes.fr/paris/1764491-20160112-paris-belib-reseau-60-stations-recharge-voitures-electriques-mardi>.

In terms of infrastructures, the city only counts 180 charging stations with the network Belib' (even if Paris officials plan to increase the number to 270 by the end of this year). However, their maximal power is 22kw, which represent 1 or 2 hours of charging and which is too long and pricey, especially for people who need to leave their cars for the whole day. Indeed, charging costs €1 for the first hour and €16 per hour from the second hour (it is only free at night). There also existing plugs that are offered by private actors, like markets, highways or gas stations. Their power is superior (50kW, around 30 minutes of charging) but there are very few at the moment. The Autolib charging stations can also be used by individual electric vehicles, however it is quite hard to find unused plugs.

The municipality also offers a service of free parkings : residential parking for 7 consecutive days and visitor parking for up to 2 hours. It only works with outside parking areas, which can be difficult to find.

(2) Financial incentives

The majority of financial incentives are at a national scale and not just specifically aimed at the city of Paris. The French state guarantees €1000 to citizens that switch an old diesel car (more than 13 years old) for a non-polluting one. This aid can go up to €4000 when citizens buy an electric car. Citizens can also benefit from an ecological bonus of €6000, reaching a total of €10000 when they purchase an electric car. Finally, they can also benefit from a tax credit of 30% when they install private charging stations.

In particular, in Paris there are several incentives for the installation of charging stations. The municipality incentivizes individuals' co-ownership of charging points by paying 50% of the installations costs (with a maximum of €500).

There are also several discounts for an Autolib' pass for some specific segments of the population (i.e. young people, people who abandon their oil car, etc).

(3) Private players

There are several private actors active in this field so we decided to take into consideration three of them conducting business in different fields in the industry. By taking a closer look on these three active players in France, we can obtain a broad picture of the actions of private sectors to promote electric vehicles in Paris, from which we can clearly identify what has been done so far and what can be improved in the future.

DBT

DBT provides convenient and efficient electric vehicle charging solutions, which aim at solving the most practical problem faced by electric vehicles. It's the leader in charging infrastructure in Europe as well as a pioneer in electro-mobility with 25 years of experience in the industry. They provide a wide range of charging solutions for electric vehicles and Plug-in Hybrid EV. They have around 10,000 charging points installed on more than 500 sites, also with a huge presence in Paris. What is more, they also participate in several ambitious e-mobility projects in the major world cities, from Milan to Stockholm, from Dublin to Moscow through London and Paris in order to propose new solutions for future's EV. ⁸Since the accessibility of charging has always been one of the major issues preventing people from driving an electric vehicle, DBT's work can effectively push the industry to move forward. Now DBT is expanding quickly and is searching for commercial and technical supports all over Europe.

Ian Motion

Ian Motion is a pioneer in automobile recycling and electrifying, which is a relatively new field in the business with enormous potential. It's a Parisien startup aiming at taking part in the green transition by turning existing vehicles into restored electric ones, offering them a real zero emission second life. They realized that a huge number of old vehicles are sleeping in the garage, not being used by their owners⁹, so they come up with the idea to buy the old vehicles and transform them into electric ones. By doing this, they help reduce the pollution of industrial waste as well as reduce the polluting emissions. Currently, they are still in the phase of prototype. The first transformed vehicles will be opened for ordering at the end of 2017. Thus, the market reaction, the future of the start-up and the whole "transformation" business remain as a question mark, but we are convinced that it signifies an increasing business interest in the combining automotive industry with the concept of recycling and new energy.

⁸ DBT CEV 2017. "Electric Vehicles charging solutions DBT CEV". *DBT CEV*, <http://www.dbtcev.fr/en/>.

⁹ Dupont-Calbo, Julien. 2016. "Trois start-up françaises qui veulent faire bouger le monde de l'auto". *lesechos.fr*, https://www.lesechos.fr/07/01/2016/lesechos.fr/021602579686_trois-start-up-francaises-qui-veulent-faire-bouger-le-monde-de-l-auto.htm.

Clem'

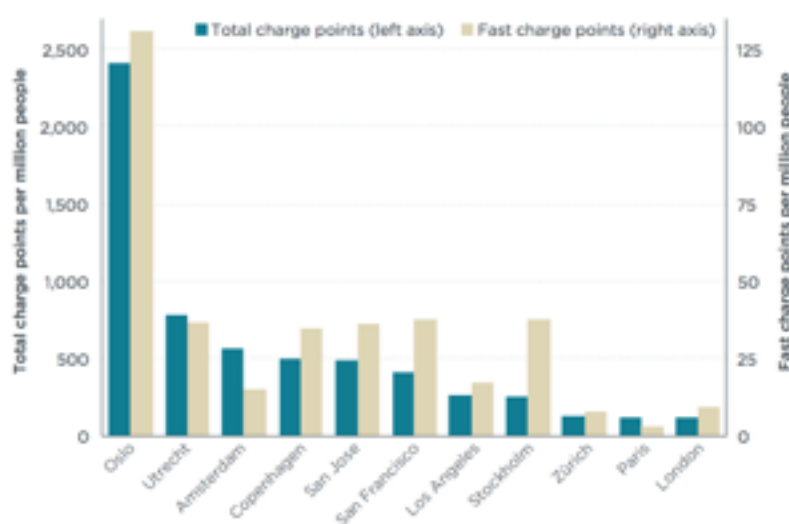
Finally, in the booming age of sharing economy, Clem' has developed since 2010 an online platform dedicated to electric vehicle sharing, which can be accessed via web and mobile application. With the mission "shared eco-mobility" in mind, the company has come up with a user-friendly platform, combined with a series of services to improve the convenience of the electric car journey, such as charging points reservation, carpooling arrangement, and travel information.¹⁰ Furthermore, M'Key is a key box developed by Clem' in order to enable the sharing without any physical modification to the vehicle, which means users can get the key via their smartphone after they book the car on the platform. This hardware solution assures convenience and security at the same time.

(4) What is impeding the mass adoption of Electric Vehicles in Paris

In 2015 the total of electric vehicles in Paris accounted for 1.8% of total vehicle sales¹¹. This number was above national average but below other European cities, like Amsterdam, Zurich and Stockholm. Indeed, although the French capital has taken several initiatives and worked on policies that can facilitate the adoption of electric vehicles, there are still several issues that obstacle a mass adoption of such vehicles.

For instance, in comparison to other European capitals, the number of charging infrastructures is relatively low, especially when it comes to fast charging points.

Figure 1. Total electric vehicle charge points and fast charge points per million population¹²



10 Clem, 2017. Clem' | Plateforme d'écomobilité | Autopartage véhicules électriques". Clem'. <https://www.clem-e.com/our-solutions>.

11 Dale Hall; Marissa Mourtak & Nick Lutsey. 2017. "Electric Vehicles Capitals of the World". ICCT. http://www.theicct.org/sites/default/files/publications/Global-EV-Capitals_White-Paper_06032017_vF.pdf.

12 Dale Hall; Marissa Mourtak & Nick Lutsey. 2017. "Electric Vehicles Capitals of the World". ICCT. http://www.theicct.org/sites/default/files/publications/Global-EV-Capitals_White-Paper_06032017_vF.pdf.

According to a study carried out by Sia Partners¹³, there is indeed a strong correlation between the presence and density of public charging stations and the success of electric vehicles in either a city or a country. The presence of public charging points is extremely important as home charging alone is not sufficient to enable the mass adoption of EVs. In addition, whilst it is true that home charging remains one of the most predominant and important ways to charge an electric vehicle, not all households have private parking, therefore public charging is and will remain a necessity.

Another obstacle to the mass adoption of electric vehicles is their higher price. Even though in the medium term their average price is likely to become competitive, in the short term until 2020-2025 their price is likely to remain more expensive, alongside their running costs, in comparison to other ICE vehicles (internal combustion engine)¹⁴. This represents an important barrier for consumers, who might be more myopic or constrained by their financial availabilities. Indeed, lower income households might be the most affected by such price constraints yet for a mass adoption of electric vehicles it is fundamental that both low and middle income households start purchasing them.

Furthermore, the cost of second hand electric vehicles is also high. The second-hand market could be a potentially good solution, especially for lower income households and could incentivize a wider adoption of EVs. However, Paris, as well as France on a bigger scale, doesn't have in place policies aimed at facilitating the second-hand market of both electric vehicles and batteries.

Finally, despite the city of Paris offering some non-financial incentives, there is still room for improvement, especially if comparing them to the ones offered by other European capitals. Indeed, as of March 2017, the main incentives offered by the French capital are free parking and the possibility to use EVs in city streets where high polluting vehicles are usually banned on weekdays. However, if looking at the example of Oslo, the difference in the offering is quite substantial. The Norwegian capital offers both free electricity for normal charging (.3.6 kW) and free municipal planning, bus lane access, discounted quick and semi-quick charging for prioritized vehicles and is also planning low emissions zones.¹⁵

13 Sia Partners, 2016. "Public charging infrastructures : essential for the mass adoption of Electric Vehicles | Energy Outlook". *Energy.sia-partners.com*. <http://energy.sia-partners.com/20160927/public-charging-infrastructures-essential-mass-adoption-electric-vehicles>.

14 Oliver Sartor; Thomas Spencer & Oliver Fryatt, 2017. "Electric vehicles in France: A fifteen-year financing plan for massive rollout". *Iddri.org*. http://www.iddri.org/Publications/Collections/Analyses/ST0817_OS%20et%20al._EVs%20financing.pdf.

15 Dale Hall; Marissa Mourtak & Nick Lutsey. 2017. "Electric Vehicles Capitals of the World". *J CCT*. http://www.theicct.org/sites/default/files/publications/Global-EV-Capitals_White-Paper_06032017_vF.pdf.

To conclude, whilst Paris is one of the most invested European cities in the mass adoption of electric vehicles, there are still several obstacles that impede to meet such goal. Looking at the examples and policies put into place by other countries and cities can play an important role in the development of new policy and operational recommendations, which are what will be discussed in the second part of this brief.

II. CASE STUDIES, WHAT HAS BEEN DONE IN OTHER COUNTRIES AND CITIES

(1) San Francisco

National context and incentives

As seen on the graph below, the United States has one of the biggest electric car stocks in the world with a little more than 600,000 EVs. It is the second country with the largest stock, following China very closely. The world electric car stock growth rate in 2016 was of 60%. It is a fast paced growing industry¹⁶.

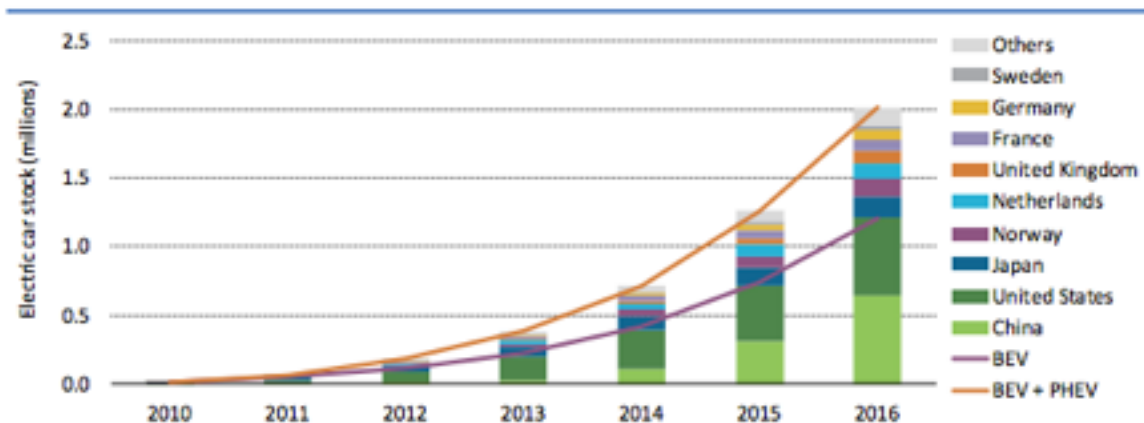


Figure 2: Evolution of the global electric car stock, 2010-16¹⁷

¹⁶ Alfred Wiederer & Ronald Philip, 2010. "Policy options for electric vehicle charging infrastructure in C40 cities". *Innovations.harvard.edu*. <https://www.innovations.harvard.edu/sites/default/files/1108934.pdf>.

¹⁷ Alfred Wiederer & Ronald Philip, 2010. "Policy options for electric vehicle charging infrastructure in C40 cities". *Innovations.harvard.edu*. <https://www.innovations.harvard.edu/sites/default/files/1108934.pdf>.

Financial efforts have been made to encourage and support the adoption of advanced technology vehicles, as it can be seen in the table below. For example, tax credits have been put in place as well as investments in Research and Development, and emissions benefits in some specific States.

Type of Incentive	States
HOV, Parking, or Registration Privileges	Arizona, California, Colorado, DC, Florida, Georgia, Hawaii, Iowa, Maryland, Minnesota, Nebraska, New Jersey, Ohio, Tennessee, and Virginia
Emissions Benefits	Alaska, Arkansas, California, Connecticut, Florida, Michigan, Missouri, Nevada, Oregon, and Washington
Tax Credits, Rebates, or Grants	DC and 40 states
Purchase Directives, Promotion Directives, or Mandates	DC and all states (except for Arkansas, Colorado, Florida, Georgia, Maryland, Michigan, Nebraska, Pennsylvania, and Virginia)

Figure 3: 2010 Status of US State level incentives for HEV¹⁸

Moreover the new Corporate Average Fuel Economy (CAFE) standards are encouraging and facilitating the entry on the market of electric driven technologies. Cars and light trucks from the 2012 model year now have to comply to stricter CAFE standards as “they have to have an average fuel economy that is 16% greater than the 25.5mpg average for cars and light trucks for previous model years”¹⁹. It also stipulates that the average fuel economy needs to be 33% greater in 2016 than in 2011 models.

Specific incentives in San Francisco

We will now illustrate the impact of these policies in favor of electric vehicles with the example of the city of San Francisco. As it is located in California, it benefits from all the measures shown above.

San Francisco has one of the highest concentrations of electric vehicles in the world. Thus the city offers one of the most electric vehicle-friendly environment for drivers. Firstly,

¹⁸ HEV TCP, 2017. "Policies & Legislation, United States | IA-HEV". *ieahev.org*. <http://www.ieahev.org/by-country/united-states-policy-and-legislation/>.

¹⁹ HEV TCP, 2017. "Policies & Legislation, United States | IA-HEV". *ieahev.org*. <http://www.ieahev.org/by-country/united-states-policy-and-legislation/>.

since 2009 San Francisco has installed around 400 charges points²⁰ (as shown in the map below) making the city one of the most efficient in terms of charging power and the number is expected to rise in the coming years.

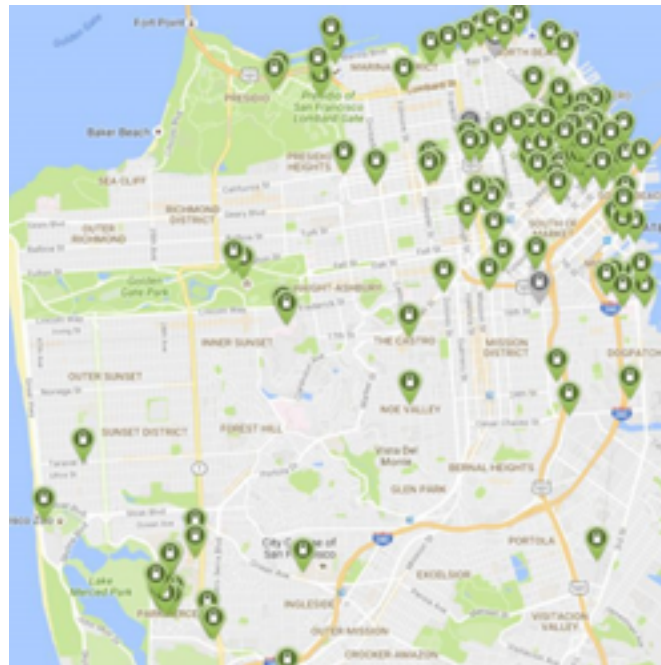


Figure 4: Public charging points in San Francisco²¹

San Francisco is also a leading city in the installation of charging utilities in car parkings. In March 2017, the city announced a plan that will require all new buildings to have electric vehicle stations installed (much like they have in the past with solar panels). Buildings within the city must be 100% electric vehicle ready and all parking structures must accommodate electric vehicles with at least 10% of the space²². One specific example of the installation of electric vehicle utilities can be found directly into a condominium:²³ 1 Federal is a loft-style condominium in San Francisco's South Beach area, located at 200 Brannan Street.

Chargers are also installed in parking spaces deeded to each PEV owner. Individual PEV owners pay for the installation and operation of the chargers. Installation costs range from \$1,000- \$2,800, depending on the distance of the conduit run between the parking space

20 Sf Environment, 2017. "Clean Vehicle Infrastructure". [sfenvironment.org - Our Home. Our City. Our Planet. https://sfenvironment.org/electric-vehicle-charging-stations.](https://sfenvironment.org/electric-vehicle-charging-stations)

21 Ibid

22 <https://electrek.co/2017/03/01/san-francisco-electric-vehicle-charging-ready/>

23 Pev Collaborative, 2017. "Multi-Unit Dwelling". [Pevcollaborative.org. http://www.pevcollaborative.org/multi-unit-dwelling.](http://www.pevcollaborative.org/multi-unit-dwelling)

and the electrical infrastructure. Residents pay for charging services via a fixed monthly charge of \$15/month plus a flat electricity rate for usage (in \$/kWh).

(2) The Netherlands

In the Netherlands a heavy emphasis has been given to the deployment of electric vehicles for transport. Given the small size of the country, the geographic spread out and small distances, there is a high potential of plug-in electric vehicles in the country and the Dutch government has been really progressive in noticing the same. The number of EVs has increased constantly over the last few years and as a matter of fact, the country now enjoys the second highest electric car market share in the world - 6.4%²⁴.

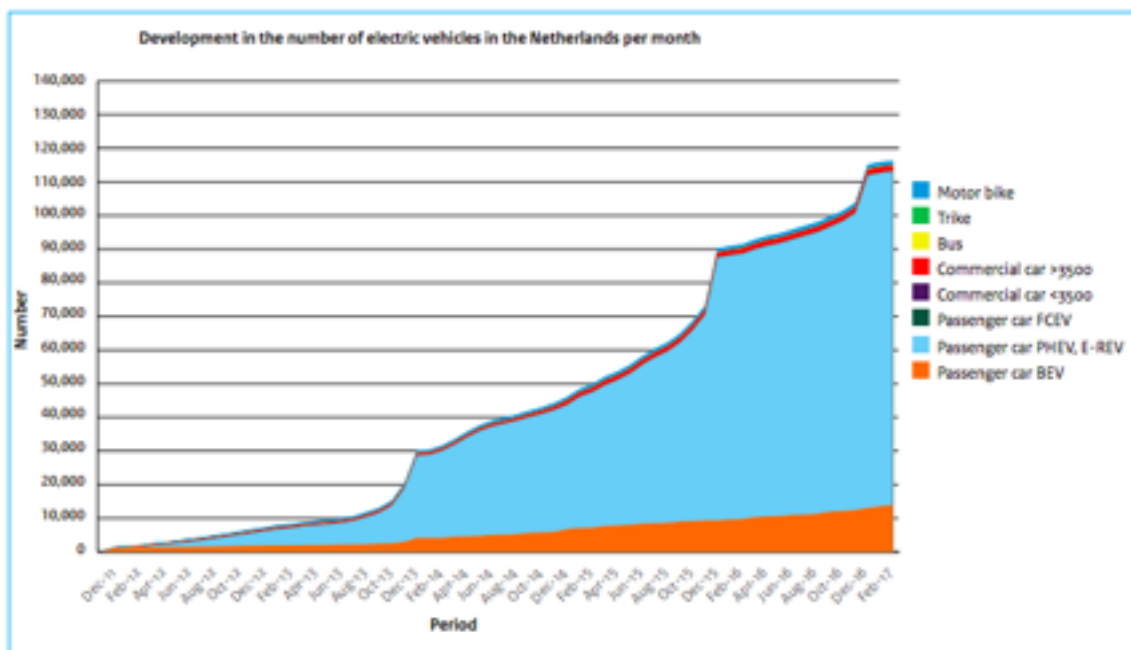


Figure 5: Development in the number of electric vehicles in the Netherlands per month²⁵

By the end of 2016, there were around 110 000 electric vehicles registered in the Netherlands. It is around the same as in France, whereas the number of inhabitants is 4 times smaller.²⁶ But why does it work so good ?

²⁴ IEA, 2017. "Global EV Outlook 2017". *iea.org*. <https://www.iea.org/publications/freepublications/publication/GlobalEVO Outlook2017.pdf>

²⁵ Ministry of Economic Affairs, 2017. "Vision on the charging infrastructure for electric transport". *Ministry of Economic Affairs*. <https://www.rvo.nl/sites/default/files/2017/05/Vision%20on%20the%20charging%20infrastructure%20for%20electric%20transport.pdf>.

²⁶ Netherlands Enterprise Agency, 2017. *Rvo.nl*. <https://www.rvo.nl/onderwerpen/duurzaam-ondernemen/energie-en-milieu-innovaties/elektrisch-rijden/stand-van-zaken/cijfers>.

Charging Infrastructure

By the end of 2016 The Netherlands had 26 000 public charging points and 72 000 private ones (at home or in private context : for employees for example) ²⁷. It has kept pace with the increasing number of EVs every year. The government policies have been very supportive in helping the private players keep up with the infrastructural needs. Key cities like Amsterdam, Rotterdam, Hague, Utrecht and Brabantstad were designated as key focus cities to create a snowball effect, which ended up being a success. They have set targets to have at least 1,000,000 million EVs on road by 2025 and have made a conscious effort towards building a sustainable infrastructure.²⁸

Moreover, a network of publicly accessible private fast charging points (50 kWh) has been set up in Holland between the major cities on the main road. This was made possible by amending the Facilities Policy and thereby allowing market players to operate fast charging points on the main road network, signifying the immense support provided by the government in working towards the greater cause.

Additionally, EV owners can also find all publicly and semi-publicly available charging points in the Netherlands on the oplaadpalen.nl website²⁹.

Free Parking Spaces

In major cities like Amsterdam, EV owners have access to free parking reserved for their EVs. Free charging is also given to them in public parking places. Similarly, in Rotterdam, EV owners are entitled to one year of free parking in downtown and they receive a subsidy on public parkings up to EUR 1,450, if they install a home charger using green electricity.³⁰

27 Ministry of Economic Affairs, 2017. "Vision on the charging infrastructure for electric transport". *Ministry of Economic Affairs*. <https://www.rvo.nl/sites/default/files/2017/05/Vision%20on%20the%20charging%20infrastructure%20for%20electric%20transport.pdf>.

28 IEA, 2017. "Global EV Outlook 2017". *iea.org*. <https://www.iea.org/publications/freepublications/publication/GlobalEVO Outlook2017.pdf>

29 Eco Movement, 2017. <https://oplaadpalen.nl/?sw=N>.

30. Roberts, Graeme. 2017. "UK: Nissan Leaf costlier in Europe even with incentives". *Just-auto.com*. https://www.just-auto.com/news/nissan-leaf-costlier-in-europe-even-with-incentives_id104404.aspx.

Financial Incentives: subsidies

Financial incentives are similar to the Parisian ones. The Netherlands and particularly the municipality of Utrecht offers EUR 500 subsidy per private charging point and EUR 1500 for a semi-public charging point (charging points set up by private actors like gas stations or hotels). Additionally the government offers through the Ministry of Infrastructure and the Environment a EUR 3,000 subsidy on the purchase of all electric vehicles. The subsidy in some cities like Amsterdam , Rotterdam, Hague and Utrecht even stretches up to EUR 5,000.³¹

Financial Incentives: tax cuts ³²

The government has been really progressive in terms of its taxation policies as well. It has introduced environmental laws that support and encourage the use of EVs all around the country. For example, in 2016 the EVs were exempted from the registration tax on cars, there was a complete ownership tax exemption for BEVs (Battery electric vehicles) and up to a 50% discount of ownership tax on PHEVs (Plug in hybrid electric vehicles) that ranged between EUR 400 to EUR 1200 from city to city. EVs began to be considered as tax deductible investments for companies as CO2/Km based tax deductions went up to 22% for PHEVs and 4% for BEVs.

For the future, the dutch government has signed the Electric Transport Green Deal 2016-2020, which is aimed at developing a vision for the charging infrastructure in the Netherlands. The vision is to address numerous aspects such as technological developments, regulations, interoperability and making the business case sound. Given to the current landscape of the EVs and the progressive attitude of the government, Netherlands is set to make a 360 degree transition into EV market and may soon pave its way through Autonomous Vehicles as well.

(3) Norway and Oslo

Norway has been working on introducing EVs since 1989 when the pop group a-ha and NGO bellona joined forces to promote EVs in Norway.³³ Today, Norway represents the largest plug-in electric vehicles per capita in the world with Oslo recognized as the capital

31 Roberts, Graeme. 2017. "UK: Nissan Leaf costlier in Europe even with incentives". *Just-auto.com*. https://www.just-auto.com/news/nissan-leaf-costlier-in-europe-even-with-incentives_id104404.aspx.

32 IEA, 2017. "Global EV Outlook 2017". *iea.org*. <https://www.iea.org/publications/freepublications/publication/GlobalEVO Outlook2017.pdf>

33 Norwegian Electric Vehicle Association, 2017. "Norwegian EV policy". <http://elbil.no/english/norwegian-ev-policy/>.

of electric vehicles. Norway became the first country in which every 1/100 personal cars are electric cars. The market concentration of plug-in cars was 21.5 per 1000 people which is more than ten times the market share in the U.S. Furthermore, the plug-in EV market share of new cars reached 29.1% in 2016 and was marked the highest market share in the world.

Further ahead, the Norwegian parliament has released an objective 2025 in which they target 100% or zero emission vehicles on the personal and light commercial car market. Thus, Norway and particularly Oslo is an interesting case to study, particularly regarding the incentives that were put in place to create such a growth in EV consumption and also on their offer for charging services.

Charging Infrastructure

In March 2016, Norway had 7,632 electric recharge points and ~1,996 of which in Oslo³⁴. The charging infrastructure was built in 2010 and to maximise the benefits of it, the government entity Enova and the Norwegian association of electric vehicles collected all the information on a central database to offer the knowledge of location and availability of chargers. The vision for 2020 would be to offer around 25,000 public charging points as per European Clean Power for Transport directive's recommendation of one charging point per 10 electric cars³⁵.

Norwegian government highly supported the development of basic charging infrastructure between 2010 - 2014, it funded the entire 100% installation cost. But since there was a slow demand for charging stations, the state firm Enova announced a support scheme to have charging stations at every 50kms on the main roads. The complete network should be operational towards the end of 2017.

Overall, there are four types of charging infrastructure: public which are open to all, semi-public which have certain restrictions, fast charging - that uses a higher technology and private points that are connected to a private energy supply. The fast charging operators are segmented in small segments and rely mainly on public funding, but some of them in larger cities and along major highways are building fast charging stations without the government's funding which shows the explosion of the market where it becomes financially interesting to invest in EVs.

34 017. Wikipedia, 2017. "Plug-in electric vehicles in Norway". https://en.wikipedia.org/wiki/Plug-in_electric_vehicles_in_Norway.

35 Norwegian Electric Vehicle Association, 2017. "Norwegian EV policy". <http://elbil.no/english/norwegian-ev-policy/>.

Financial incentives

As mentioned in the introduction, Norway abolished tax on purchase in 1990 which was later made permanent in 1996. EV cars and vans are exempted from the purchase tax and the 25% VAT. In 1996, they also reduced the annual road tax for EVs owners and one year later exempted them from the road toll. In 2000, the parliament also passed a law to reduce 50% of company car tax. Additionally, in 2013 the government approved another tax reduction for plug-in hybrids that will exist at least through 2017, following which, the parliament will consider reducing some of the incentives in January 2018 if they believe that they have achieved their targets for 2017.

Incentives on parkings and driving

In 1999, the government decided to offer free municipal parking spaces for EVs, but in March 2016, the Ministry of Transport issued new regulations. These regulations, that were in effect till January 2017, terminated the free parking for ZEV, but established that counties and local authorities can introduce payment exemption for battery or plug-in electric vehicles on municipal parking. In 2003, Oslo authorized the EVs to be driven on the bus lanes. This pattern was further extended to the entire country by 2005. Additionally, by 2009 they were even granted free access on the state ferries.

Results of these policies

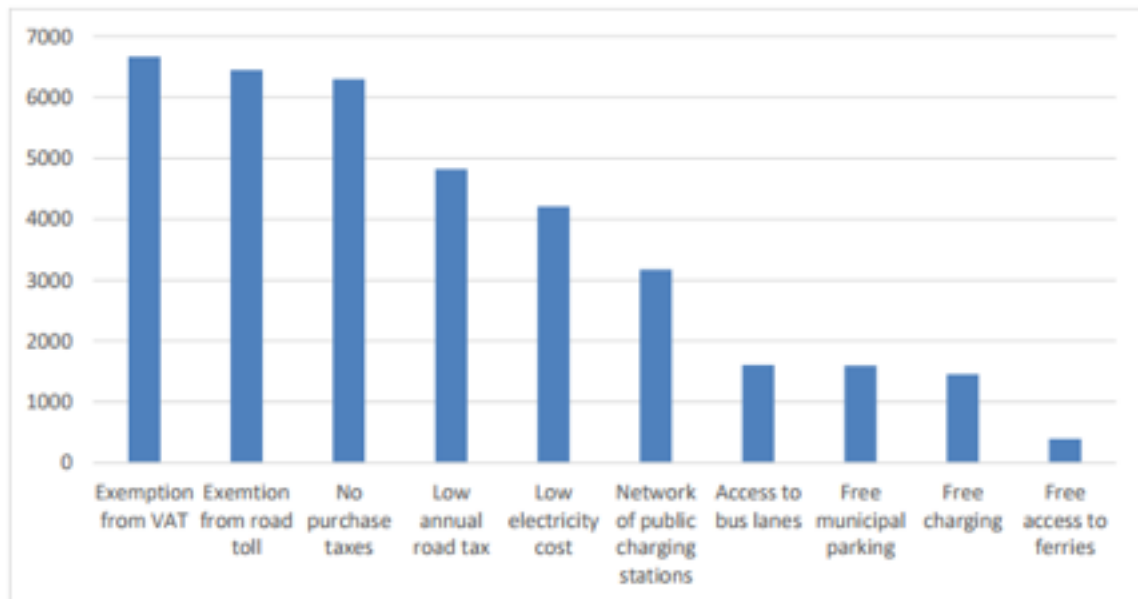


Figure 6: Most important EV incentives according to Norwegian EV owners³⁶

The Norwegian EV association released the results from their Norwegian EV owners survey in 2017, thanks to this data it is seen that the incentives that are the most important for owners are financial, particularly the tax reduction/exemption.

It is notable that some complaints have been made about the incentives offered by the government. Firstly, the high public subsidies in comparison with the reduction of the reduced carbon footprint, secondly, the traffic congestion that can be created on the bus lanes particularly in big cities like Oslo were high. Finally, some ferry operators have complained about a loss of profit due to the high number of EVs exempted from payment.

To conclude, the Norwegian case shows that the best incentive to increase the number of EV users are financial incentives. Plus we can see that the number of charging networks is not primordial for early users. The most valued incentive for Norwegians EV users is the VAT exemption at the purchase, which is explainable by the considerable difference in price between buying a regular fuel or diesel car from an electric. Closely followed with other financial incentives, well developed charging infrastructures and tools such as an app to locate them are nice plus but are not enough in itself to buy an EV.

³⁶ Erik Lorentzen, et al. 2017. "Charging infrastructure experiences in Norway - the worlds most advanced EV market". *EVS30 Symposium*. <https://wpstatic.idium.no/elbil.no/2016/08/EVS30-Charging-infrastructure-experiences-in-Norway-paper.pdf>.

III. RECOMMENDATIONS

From the three case studies presented before, recommendations can be made to improve the policies set up in Paris.

(1) What are the main aspects to work on ?

Studies and case studies have shown that there are two major incentives that can be used to convince people to use electric vehicles : the number of recharging stations and financial incentives.

The city of Paris has focused a lot on its shared electric vehicles, Autolib. This system is well-thought and works quite well, but it has several limits. The most important one is that it can be hard for people to find a parking area for their Autolib after using it as the number of places to give them back are limited. And especially outside Paris, some cities don't have any partnerships, so it is not possible for their inhabitants to use this system. Globally the sharing system is limited to urban moves, either daily ones, or exceptional ones, and does not enable the same liberty as individual ones. That is why it seems relevant to develop simultaneously policies to encourage the use of private electric vehicles. In the following years it could also enable people from other parts of France to come more easily to the capital with their electric vehicles and so to encourage a global electric mobility.

Outside this system, infrastructures for individual vehicles are limited. The number of charging stations installed in the city is not very important, which can be a brake to the use of electric vehicles. And especially as their power is intermediate and forces people to wait at minimum 1 hour and to pay from the second hour. This could be a development point for the policy.

Concerning financial incentives, there are already very interesting financial incentives for an electric car purchase or the installation of a private charging station, which can really convince people to invest, so it is not a true break but it is possible to go even further. What is missing is a more long-term incentive and the exemption of certain long-term costs, following what was done in Oslo, for example.

Finally, an important aspect in the context of Paris is the parking area. A big part of driving in big cities is due to parking space areas researches. What could convince people to use electric cars instead of oil ones, could be the ability to park more easily.

(2) Ideas of policies improvement

Enhancing the development of charging points

In terms of recharging stations it is evident that it's the first step for an efficient policy. Paris compared to other cities in the world has few fast stations, which is a big brake to EVs adoption, especially as lots of people don't have parking and personal spaces to plug them at home. The adoption of recharging stations should be thought at the regional scale.

The consumers' resistance is mainly due to technological and ecosystem issues. According to a survey led on French population, 58% of the respondents stated that the limited autonomy of batteries is the main EVs' drawback, and 28% stated that it is the scarcity of electric infrastructures to charge those vehicles³⁷. Therefore the main lever to engage in order to incentivize the use of electric vehicles is to compensate the customers' anxiety of finding more easily charging points.

Regarding the urbanism of Parisian area, it seems difficult to develop charging infrastructures in streets as there is not a lot of space. Parking areas are saturated, especially as from 2001 till 2012, there were around 23,000 kerbside parking spaces removed (loss of 15%). Parisian urbanism is definitely not in favour of installing charging points at every corner, in particular in a context in which 20% of the Parisian traffic would be caused by searches for parking spaces.³⁸

That is why it seems necessary to focus on privately held car parks as for the development of charging points: parking facilities represent 50% of the Parisian offering, and is far more leverageable (compared to on-street car parks). However their costs are often a barrier: the average daily cost in Paris and its urban area is 29.41€, going up to 38€³⁹.

Therefore we recommend a close partnership with private actors, owning the majority of parking facilities (underground car parks in Paris, on-street/off-street in its suburbs);

37 Statista, 2016. "D'après vous, quels sont parmi les suivants, les deux principaux inconvénients de la voiture électrique ?". <https://fr.statista.com/statistiques/616710/opinion-francais-inconvenients-voitures-electriques/>.

38 Jean-marc B. et al. 2016. "Combien de temps perd-on à chercher une place de parking ?". *Club de Mediapart*. <https://blogs.mediapart.fr/lesaviezvous/blog/220916/combien-de-temps-perd-chercher-une-place-de-parking>.

39 Parking in Paris, 2017. "Parking par Prix (pour 24 heures) - Parking In Paris". *Parkinginparis.fr*. <https://parkinginparis.fr/parking-prix/>.

municipal parking being irrelevant in Paris' urbanism. The car parks' exploitation market is quite competitive, even though some actors such as Indigo, former Vinci Park, benefit from a far bigger market share.



Our policy will aim to establish a partnership with those actors exploiting car parks, in order to :

- **create a special tariff for electric cars**, which consists in only paying the battery charge and not the space itself; this being supported at 1/3 by ordinary cars drivers, by increasing parking tariffs, and at 2/3 by government subsidies. In addition we recommend to extend the free on-street parking for EVS as already implemented in Paris. Partnerships with actors like DBT seem also necessary to set up these charging points;
- **incentivize investments for charging points** in those car parks, as charging facilities are scarce in Parisian urban area. We can develop this point in two directions: varied construction projects being ongoing in Paris' suburbs, one point would be to enforce the new infrastructures to be equipped in charging points, at least 20% of the parking capacity. Then for existing infrastructures, there should be a longer period to equip them in charging points, 20% of their capacity too, which will be subsidized.

In parkings 50 kW charging stations can be installed, it means 30 minutes of charging. We could think of a particular service in some of them : parking employees could move themselves electric cars to enable the turnover on charging stations and to have the possibility to recharge a huge number of vehicles during the day (not limited to the number of charging points).

“Park and ride” incentive

In order to promote electric vehicles' use for daily trips, and without impacting the car traffic in the city center in a negative way, one should pay attention that the implemented policies do not lead to the substitution of public transportation by electric vehicles. In this perspective it does not seem relevant to enable electric vehicles to use bus lines or to give them any peculiar advantages when driving.

Policies have already been implemented in order to avoid a massive flow of cars in big city centers. “Park and ride” seems to be the most efficient one. The principle is the following: people coming from another city or from the suburb of the big city drive the car until the parking lot, located nearby the center. After letting the car parked, they are able to continue the travel until the final destination using public transportation (in most cases, subway or bus). To make it easier for car drivers, such parking lots are very well indicated on the main roads, and the ticket for parking lots very often includes the two-way ticket for all car passengers. This solution offers several advantages for the car driver. Firstly, the place is easy to find and big enough to make sure there is always one place free. It is a point that city centers' parking places cannot offer. Secondly, it is quite cheaper than letting the car in the center. And thirdly, the car driver avoids the stress caused by driving in a dense city.⁴⁰

Because this policy is recognized as a success, it is evident that promoting electric vehicles for people living in city suburbs should be implemented in this frame. That is why the partnership offered to private companies will be implemented not only in the city center, but also in the “park and ride” places in the suburb. It does imply an enrollment of the administrative “commune” of the very suburb of Paris. The priority will obviously be put on the locations where a metro or RER line crosses over. For instance, people coming from the South of Paris and wanting to join the Roissy-Charles-de-Gaulle airport, in the North of the metropolis, could drive until Porte d'Orléans, Cité universitaire or Porte d'Italie, in order to continue the travel with the line 3a and the RER B. However, the farther the parking lot is located, the better it is. Indeed, the car produces less pollution and less traffic, and unconstructed places are easier to find and cheaper if they are far from Paris.

In order to make building parking lots outside Paris interesting for companies, Grand Paris and the French state should provide fiscal incentives. However, it is obvious that the density around existing subway stations is high, which makes it hard to build new places at

⁴⁰ Sareco.fr, “Glossaire du stationnement et de la mobilité”, [http://www.sareco.fr/fr/notre-metier/glossaire-du-stationnement#Parc%20Relais%20\(ou%20P+R\)](http://www.sareco.fr/fr/notre-metier/glossaire-du-stationnement#Parc%20Relais%20(ou%20P+R))

these locations. That is why the local authorities should concentrate on future lines, in construction in the frame of the Grand Paris Express.

Financial incentives

Then, even though these first measures intend to improve the facility ecosystem for EVs, it is to highlight the price barrier for those vehicles: according to a survey led on French population, 45% of the sample feels that the cost of EV is an inconvenient⁴¹. Indeed, the offering has got enhanced in the past years, the cost of a basic model is always around 20,000€, while the average budget for car acquisition in France is 5,883€⁴². And as such vehicles are not bought substantively, there is not any potential second-hand market emerging. Hence it is necessary to implement a stronger demand shock to promote electric cars, and the Norwegian case illustrated perfectly the impact of financial incentives. We recommend then to :

- **Cut acquisition taxes** to create this demand shock: exemption of VAT for a new EV, of registration tax, and exemption of paying road tolls, for a 5 years period, extensible if results are positive.
- Create **a loan with a zero interest rate** for the acquisition of a new EV.

It could also be interesting to work with actors like Ian Motion, which transform old cars into electric cars. Subventions could be given to these kind of actors to help them develop their technologies and enable users to have access to their services.

Communication

Finally communication should not be underestimated. Indeed pieces of information about incentives (financial contributions, reserved parking areas, etc.) should be made available to people and not only limited to the website of Paris. Currently lots of people have no idea that some incentives exist. Advertising campaigns (i.e. television, advertising poster in streets or in the metro), the use of social networks or other tools to touch a broad public could be good ways to inform and inspire people. In addition, a strong communication

⁴¹ Statista, 2016. "D'après vous, quels sont parmi les suivants, les deux principaux inconvénients de la voiture électrique ?". <https://fr.statista.com/statistiques/616710/opinion-francais-inconvenients-voitures-electriques/>.

⁴² Guillaume Poingt, 2017. "5883 euros, le budget voiture moyen des Français en 2016". *Le Figaro*. <http://www.lefigaro.fr/conso/2017/03/30/20010-20170330ARTFIG00205-budget-voiture-c-est-en-lorraine-qu-on-paie-le-moins-et-en-paca-qu-on-paie-le-plus.php>.

could also facilitate the development of a second hand market, which could facilitate the mass adoption of electric vehicles among all social classes.

Moreover it seems important to give access to people to an update database with a map of existing charging stations and their characteristics as well as pieces of information about electric vehicles and their working. Lots of information exist on Internet and there are also lots of applications and platform. It can be a little confusing, especially as most of them are made by users themselves in cooperation and are not always updated. At a regional scale it is easier to offer this database than at a national scale- charging stations just need to be identified by local actors and bringing together, as what has been done by the Norwegian association of electric vehicles.

Projections

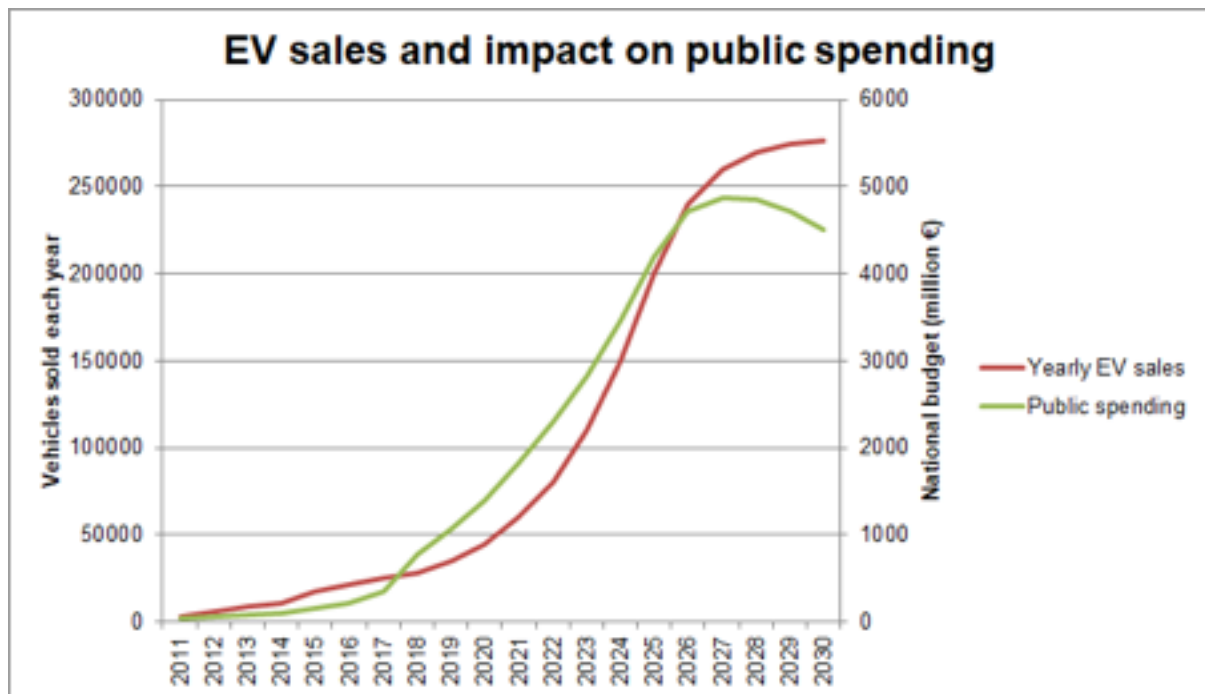
Projections are made for the whole of France, as it is difficult to identify the exact number of electric vehicles limited to the area of Paris. Moreover the aim at long-term is to develop electric cars in the whole country : if these recommendations get implemented, more cities could follow the Paris example.

Considering an average sales growth of 30% starting from 2017 (seems rather pessimistic considering the growth per year between 2011 and 2017⁴³, but it would be the “worst case” projection), the projection of EVs sales is presented below in relation with public spendings, considering the following policy : we keep the already existing subsidies and the state spend 3,000€ more per EV (reimbursement of VAT), and two third of 30€ on a daily basis (subsidies for private parking owners). Both subsidies are considered decreasing after the shock of the first years and because prices of basic electric cars production will decrease (more sold cars includes lower costs for car makers).

In the middle-run, public subsidies would be available for so many cars that the budget would explode. That is why the policy offered should be already adapted in the coming years. It should be used as a way to create a shock of demand, and make the market profitable for car makers. Indeed, even with a “bonus-malus” solution, the projected budget of 2030 could not be financed only by classic car buyers, if there is no adaptation. In the following projection, the budget per EV is decreasing starting from 2023. In addition, we observe that the global public budget is decreasing in 2027 and during the following years, whereas sales continue to grow after 2027.

⁴³ Automobile propre, “Chiffres des ventes et immatriculations de voitures électriques en France”, 09.12.2017, <http://www.automobile-propre.com/dossiers/voitures-electriques/chiffres-vente-immatriculations-france/>

One criticism on that projection could be that in 2030, only 280,000 EVs will be sold on a yearly basis. It looks like a low objective compared to the yearly 2 millions cars sold each year in France⁴⁴. However, two remarks should be made. Firstly, electric vehicles remain a part of the solution. Authorities should keep in mind that promoting public transportation, and thus making car uses less usual, will be much more efficient to reach the pollution goals. It means that the overall number of vehicle should decrease. Secondly, EVs make sense in big cities like Paris, where the impact of urban traffic on health is very high. However, it has no huge impact on the life in rural areas. And it still pollutes indirectly, through electricity production. That is why the 280,000 EVs could be sold as following: 150,000 EVs in the Grand Paris, 40,000 vehicles in both Lyon and Marseille, and the rest in other big French cities. As our policy is focussing on the Parisian metropolis, one can argue 150,000 EVs sold each year would be an amazing result.

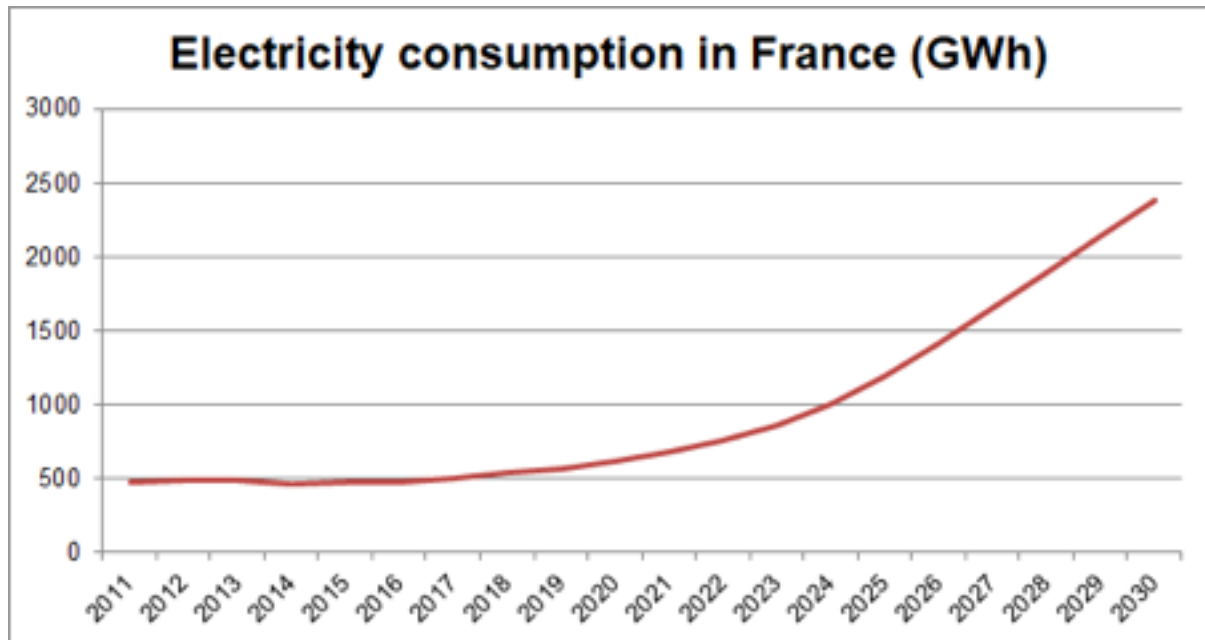


Considering the previous projection of new electric vehicles sales, and taking into account that a classic EV consumption is about 10 kWh per 100km⁴⁵, and that the average yearly distance is 10,000km per year, we can assume the national electricity consumption would increase very fastly. The yearly consumption would be multiplied by 2,5 between 2017 and 2025. It means France should seriously pay attention that the national production increases. Obviously, the short delay will be problematic concerning the sources of energy

⁴⁴ Planetoscope, 10.12.2017, "Statistiques : Ventes de voitures en France". <https://www.planetoscope.com/automobile/85-ventes-de-voitures-en-france.html>

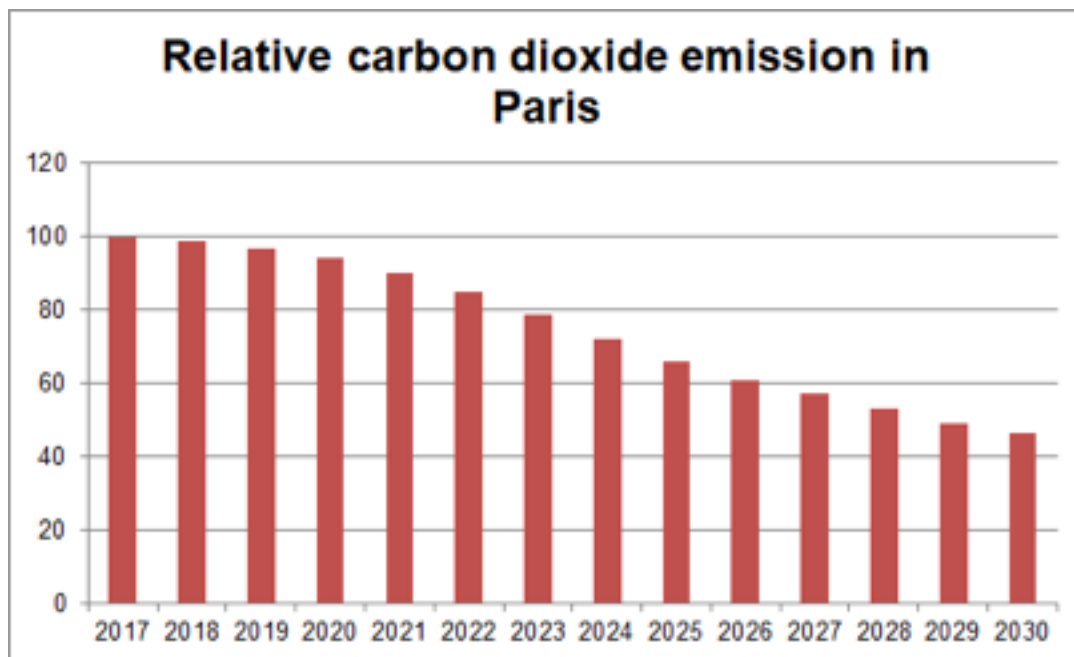
⁴⁵ Energuid.be, 2017, "Quelle est la consommation d'une voiture électrique ?". <https://www.energuid.be/fr/questions-reponses/quelle-est-la-consommation-dune-voiture-electrique/212/>

the society want to use. However, considering electric cars are replacing polluting ones, whatever the energy source (even oil or coal), the total amount of pollution would not largely increase. It is even the occasion to produce less polluting gases, either by investing a lot in renewable energies, or by increasing the capacity of the nuclear production.



Impact on the air quality in Paris

As carbon dioxide is one of the most impacting urban gas on health, we can analyse how its emission changes thanks to the implemented policy. Even if there are many other gases taken into account in the measure of the urban pollution, one should focus on a specific one in the first place. Today, about 66% of carbon dioxide emissions in Paris are due to vehicles⁴⁶. Considering a purpose of 80% Parisian vehicles being electric in 2030, the air quality and the impact on health would be significant. The following projection shows the relative level of carbon dioxide emissions compared to 2017. We observe that carbon dioxide emission in 2030 is about 46.2% as high as in 2017. The emission due to other sources than vehicles will represent $33\%/46.2\%=77,5\%$ of the total emission. They will be the priority at that moment, which is not the case nowadays.



⁴⁶ Air Parif, 2015, "La qualité de l'air en 2014 à Paris": <https://api-site-cdn.paris.fr/images/73864>

CONCLUSION

The example of Paris shows the importance of acting on different levers of action to convince people to use a new technology. In the electric vehicles case, the most important lever is the number of charging infrastructures, as well as financial incentives and parking improvements. All these measures are costly for governments but should be thought as long-term tools which will enable to reduce costs linked to pollution and health problems, and have good impacts on non-financial criteria (image of the country, happiness and quality of lives of inhabitant etc). The example of Paris has been taken to work on a concrete case, but these recommendations are usable to some extent everywhere, as long as there are adapted to each context.

The development of electric vehicles is linked with lots of issues, such as costs, electricity supplying, governing choices and so forth. It is difficult at the beginning, but as more and more countries and governments invest in this field (technologies developments and State policies), we will probably see in the years to come a fast evolution of their uses. The speed of adoption will depend on the extent of the measures put in place.

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