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An overview of government policy aimed at promoting ultra-low-emission vehicles

EXECUTIVE SUMMARY

MAY 2018

With a view to achieving carbon neutrality by the year 2050, the Climate Plan presented in July 2017 on behalf of the government by the Minister of the State and the Minister of the Ecological and Inclusive Transition seeks to halt sales of cars that emit greenhouse gases by the year 2040. Several other countries have announced their commitment to banning the sale of vehicles powered by combustion engines in various sectors and with varying timescales. This summary reviews the content of these bans and the strategies for developing ultra-low-emission vehicles in preparation for them. It examines government policy in eight countries: Germany, the United Kingdom, the Netherlands, Spain, Norway, the United States, India and China.[1] Lastly, although it mentions electric buses and light commercial vehicles and the use of hydrogen, it reflects these policies by focusing on private electric vehicles (EVs).[2]

In 2017, worldwide sales of electric vehicles reached 1.2 million, i.e. 1.5% of new car sales, an increase of almost 60% compared to 2016

Eight countries (China, the United States, Japan, Norway, the United Kingdom, France, Germany and Sweden) alone account for 90% of sales worldwide, with China largely dominating the market with sales of 600,000, 80% of which are made up of battery-powered electric vehicles (BPEV) and 20% rechargeable hybrid electric vehicles (RHEV). Four countries have set medium-term targets for halting the sale of new cars with combustion engines: by 2030 in the Netherlands, by 2032 in Scotland and by 2040 in France and in the United Kingdom. Norway has announced its intention to achieve 100% sales of electric vehicles by 2025 without banning the sale of vehicles with combustion engines, since the financial incentives it is offering should be sufficient to achieve this result. California, meanwhile, is to impose quotas on manufacturers for the sale of electric vehicles. China is expected to follow suit from 2019 and in addition has set itself targets for sales of vehicles powered using alternative energy sources (two million by 2020 and seven million by 2025). India, which had initially announced its (probably unrealistic) intention to make all its cars electric by 2030, is to focus on the (more attainable but still ambitious) target of making 30% of its cars electric by the same date. Conversely, though, sales of electric vehicles in 2017 did not exceed a few hundred, even a few dozen, in more than fifteen countries in the European Union.

Advances in battery technology have boosted investment in electric vehicles

To date, EVs in France have mainly been used for daily commuting due to their limited autonomy: quick-charge stations on freeways have remained underutilized. Recent advances in lithium battery technology (with cathodes principally composed of nickel, manganese and cobalt) have slashed their cost in half.

1. This is a summary of the report "Government policy in favour of ultra-low emission vehicles", to be published on the France Stratégie website. The report was produced by Dominique Auverlot, Nicolas Meilhan, Bérengère Mesqui and Aude Pommeret and is based on documents provided by the Treasury DG's regional economic offices in Berlin, The Hague, London, Madrid, Oslo, New Delhi, Beijing and Washington.
2. The term electric vehicle is used here to describe battery-powered electric vehicles (BPEV), rechargeable hybrid electric vehicles (RHEV) and hydrogen-powered electric vehicles (H2EV). It does not include non-rechargeable hybrid electric vehicles (NRHEV), since these can only function in electric mode for a few kilometres (the electricity being provided by recovering the vehicle's kinetic energy).

Dominique Auverlot
Nicolas Meilhan
Bérengère Mesqui
Aude Pommeret
France Stratégie

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For new private vehicles, this allows the possibility of journeys averaging a distance of 250 km (40 kWh batteries; 150 km on freeways), with under thirty minutes required to recharge their batteries by 80%.[3] This will help boost sales of battery-powered electric vehicles (BPEV), which are still principally used for daily commuting. From 2019, long distances (400 km on highways and 250 km on freeways) should become possible using high-capacity batteries (60-100 kWh), and Tesla and a number of other manufacturers are betting on this.[4] This will require major highways to be equipped with quick-charge stations with capacities exceeding 150-200 kWh; these will need to be well signposted, and sheltered from the rain where possible. As is already the case in China, it would make sense to market several versions of each BPEV model, so as to be able to offer a range of vehicles with different levels of autonomy (and a range of different prices).

Over long distances, rechargeable hybrid electric vehicles are in direct competition with BPEVs equipped with high-capacity batteries

RHEVs are dual-powered, having both combustion and electric engines; they have an electric autonomy of a few dozen kilometres. Although they represent only half of BPEV sales worldwide, they are on an equal footing on the European continent. In 2017, the respective sales of BPEVs and RHEVs were evenly balanced, the rechargeable hybrid having the slight advantage (143,974 compared to 135,369). However, this varies a great deal, depending on the country and on government incentives.[5]

BPEV and RHEV sales in 2017

	France	The Netherlands	Norway	Spain	Sweden	Germany	United Kingdom
BPEVs	24 910	9 897	33 025	3 920	4 217	25 056	13 597
RHEVs	11 868	1 158	25 165	3 370	15 447	29 439	31 154

Source: ACEA.

When government incentives result in comparable retail prices, sales of the more versatile RHEVs, which have unlimited autonomy, are higher than for RHEVs. However, several countries are less in favour of RHEVs because, since they are most frequently used in combustion engine mode, they emit significantly higher amounts of greenhouse gases than are detected during certification testing. Measures implemented in the Netherlands identified a variation of between one and three between the tests and real driving conditions, which should prompt a review of the rules governing emissions of CO_2 by RHEVs during certification in order to avoid opportunist purchasing linked to tax incentives.

In any event, reducing or abolishing subsidies too suddenly results in a collapse in sales; this happened in the Netherlands with the RHEVs and in Denmark with the BPEVs. The future of RHEVs will therefore depend on their relative cost compared to BPEVs, and also on government incentives. Future regulations should provide incentives to encourage their use in electric mode: new RHEVs with an actual electric autonomy of over 60 km which would cover 80% of commuting journeys, equipped with combustion engines for use on long-distance journeys, would bring us closer to this objective.

Hydrogen-powered electric vehicles are also capable of long journeys. However, only 3,000 were sold worldwide in 2017: production costs currently limit their use to highly subsidized demonstrations intended for "captive fleets" and heavy goods trucks.[6] An increase in the ownership of these vehicles by the general public seems unlikely before 2030.[7] The Japanese government nevertheless remains very ambitious for this sector: it has plans for 40,000 hydrogen-powered electric vehicles by the year 2020, 200,000 by the year 2025 and 800,000 by the year 2030, with a provision for 160 hydrogen refuelling stations by 2020 and 320 required by 2025.

3. On freeways, consumption is closer to 20-25 kWh/100 km.
4. A non-exhaustive list: the Kia Niro scheduled for 2018 with 64 kWh, the Nissan Leaf for 2019 with 60 kWh, the Hyundai Kona for 2018 with 60 kWh, and also the Jaguar I-pace with 90 kWh and the Audi e-tron SUV with 95 kWh, along with a large number of Chinese models that were presented in April 2018 at the Beijing Motor Show.
5. In terms of the EU-28 and the EFTA (Switzerland, Norway, Iceland and Lichtenstein).
6. Currently in the region of €66,000 for the Toyota Mirai.
7. See the work by the CEA/DGEC on the use of hydrogen in the energy transition.

The sale of electric vehicles exceeds 10% of new car sales in Norway, the Chinese cities of Beijing, Shanghai and Shenzhen and some thirty Californian cities

With a proportion of less than 3%, French and German cities are a long way behind. In the Netherlands in 2015, sales of EVs were close to 10% but, within two years, a decrease in subsidies has reduced them to a quarter of that figure. Each of these pioneering areas has a number of distinctive characteristics.

- **Norway:** The government has introduced financial incentives on a massive scale, both direct (exemption from import tax and VAT) and indirect (no toll charges for using freeways and free access to tunnels and ferry crossings, and the option of using bus lanes). Electric vehicles are therefore less expensive to buy than their combustion engine-powered counterparts and, in addition, they mainly use low-cost electricity produced from hydropower. The extent of these benefits is such that attaining the objective of 100% sales of EVs by 2025 does not rely on a ban on sales of vehicles powered by combustion engines but on consumer choice. A more widespread investment in electric vehicles is thus the result of a deliberate effort on the part of this country—which, due to revenue generated by its sales of hydrocarbons, has one of the highest levels of GDP per capita in the world—to combat climate change.[8]

- **California:** In 2016, sales of electric vehicles in California represented 50% of those recorded in the United States; 20% of these were recorded in Los Angeles alone. Firstly, there is the new trend aspect: wealthy consumers have been seduced by Tesla, a new manufacturer with the ability to reconcile protecting the environment with the advantages of digital technology and thus reinvent "car envy". The State of California has been part of this trend since the 1990s, with its "Zero-emission vehicles" programme which requires manufacturers to sell increasingly higher quotas of electric vehicles as time goes by. In addition to national subsidies, which amount to $7,500 per vehicle for the first 200,000 models sold in the United States by a single manufacturer, California has introduced a means-tested grant for the purchase of these vehicles.[9] Finally, in Los Angeles itself electric vehicles are allowed to use carpool lanes, which constitutes a significant advantage.

- **China:** Currently, China is responsible for half of all sales of electric vehicles worldwide: the country is looking to develop its automobile industry and cement its position as the sector's leading manufacturer. A "Zero-emission vehicles" programme based on the Californian model is to be launched in 2019. The current boom in EVs is due to strong financial incentives at a national level: grants toward their purchase are restricted to Chinese models, and may also be combined with local and regional aid. Together these frequently cover over half of the total purchase price. These subsidies are due to be reduced over the next few years in line with the increases in EV sales quotas which are to be imposed on manufacturers from 2019. In addition, in Beijing and Shanghai, electric vehicles account for an increasing—now the predominant—proportion of newly-allocated license plates. Finally, China is providing strong incentives for investing in two-wheeled electric vehicles (sales of 30 million in 2017), electric buses (90,000 in 2017) and electric compact personal commuters (1.2-1.5 million in 2017).

  This overview suggests that electric vehicles cannot be developed without strong financial incentives, which in the long term benefit the consumer. This goes for indirect incentives or even without sales quotas being imposed on manufacturers. Under these circumstances, and without mentioning the steady increase in the carbon component of the TICPE already provided for by law, **a number of measures could be subject to more in-depth assessment** before their potential adoption in France or in Europe.[10]

- *Sales quotas for electric and low-emission vehicles could be imposed on manufacturers*
  By regularly lowering emissions standards with respect to the average emissions of the different manufacturers' new vehicles, the European Union is in fact implementing a form of quota which acts as a significant incentive in terms of manufacturers' strategies. For the time being, the latter are tending to opt to reduce emissions from vehicles powered by combustion engines and to develop hybrid vehicles. German manufacturers, however, have

8. In third place behind Luxembourg and Switzerland in 2017.
9. Tesla and General Motors, which have already sold 178,000 and 176,000 EVs respectively in the United States, are approaching the 200,000 vehicle threshold above which national subsidies are expected to decrease substantially. In order to avoid a sharp decline in sales, these two manufacturers will need to significantly reduce their prices: this is Tesla's gamble with its Model 3, which is expected to be much cheaper than its Model S (€69,000). Unless the government, aware of the manufacturers' interests, chooses to raise this threshold: https://electrek.co/2018/03/16/electric-vehicle-tax-credit-cap-tesla-gm/.
10. Domestic Consumption Tax on Energy Products.

electric vehicles allows them to reduce the amounts of any penalties they may incur. At the time of defining the emissions standards for the period until 2030, the European Parliament expressed the hope that genuine EV sales quotas would be in place from the year 2025, thus providing each manufacturer with a target. The European Automobile Manufacturers Association has stated that it opposes any such measure, however, pointing out that its implementation would depend heavily on government incentives. The use of such quotas in Europe would still be necessary though should progress regarding EVs come to a halt.

- *Continued financial assistance currently remains essential* while the price of an electric vehicle remains higher than that of a vehicle with a combustion engine. Grants could be means-tested, as is the case in California, or restricted to electric vehicles which cost under €60,000, as is the case in Germany (so as to target those most in need). Ultimately the aim is to gradually reduce this aid over time as production costs fall.[11]

- *There could be an increased reliance on indirect incentives in France:* exemption from freeway toll charges for EVs and electric LCVs, free access to car parks equipped with charging points, parking charges that differentiate between electric vehicles and those with combustion engines, and permission to use restricted lanes. Germany will be considering the possibility of granting smaller electric goods vehicles exemption from freeway tolls.[12]

- *Introducing charges for driving in certain zones or creating zones reserved for certain vehicles* would give EVs a clear advantage. Options could be "limited traffic zones" (ZCR), established under the 2015 Energy Transition Law for Green Growth, or zone toll charges.[13]

- *Financial assistance (such as a bonus/malus) which increases with a BPEV's degree of autonomy* would partially offset the increase in cost due to a larger battery capacity and would promote the development of BPEVs with a medium to long distance range. This approach would be similar to the treatment of quotas in California, where a vehicle's autonomy is the most important factor.

- *Flexibility based on the degree of electric autonomy similar to that of the RHEV purchase grant*, again in line with California's treatment of quotas, would significantly reduce incentives in favour of vehicles with very limited electric autonomy. It would, on the other hand, stimulate the development of new RHEVs capable of covering distances of at least 60 km in electric mode.

The coordination of state and local authority measures to promote electric vehicles is an important issue. The state bears the burden of providing direct financial assistance; it falls to cities to create indirect incentives and install charging points; Regions or electricity syndicates are responsible for installing charging points throughout their areas. Rather than seeking complementarity through an a priori allocation of roles, the United Kingdom preferred to foster innovation, following a call for projects, by allocating several tens of millions of euros to certain cities that were keen to make a commitment to promoting electric vehicles: an approach such as this should result in the sharing of good practices between regions, thereby improving efficiency in public spending.

In Norway as in California, investment in electric vehicles is encouraged by the individual aspect of housing, which allows people to recharge their vehicles at home. On the other hand, in Tokyo lack of space is an obstacle to the development of EVs: 60% of the population lives in 130,000 apartments, while 90% of owners of electric vehicles live in detached houses. In cities, where apartments account for a significant proportion of housing, investment in EVs will only be possible if sufficient numbers of charging points are installed in parking lots, in garages belonging to these apartment buildings and in public areas close by.

11. The amount of aid available for the purchase of an EV In France in 2018 is 27% of the purchase price, including VAT, with an additional amount of up to €6,000 to cover the cost of battery hire if necessary. The total cost of ownership should of course be borne in mind; however, consumers tend to make choices based on the purchase price.
12. According to the *Süddeutsche Zeitung* newspaper, and reproduced on the TRM24 website.
13. In order to combat atmospheric pollution, this 17 August 2015 law introduced the option of creating "limited traffic zones" in built-up areas and in areas where a Plan for the Protection of the Atmosphere (PPA) has been adopted or is under development or review.

There will not be a real boom in electric vehicles until they become affordable for households in the lowest deciles of automobile owners[14]

This presupposes a significant reduction in the price of electric vehicles: excluding the environmental bonus, the price of a battery-powered electric Zoë is €32,600, more than twenty-five times the net monthly SMIC (minimum wage).[15] It also presupposes the establishment of a second hand market for electric vehicles, which is naturally relatively limited at the moment since it lags behind the market for new vehicles by a few years. The main obstacle appears to be purchasers' fears concerning the actual state of the batteries: the best response seems to be that batteries are guaranteed by manufacturers for an adequate period of time, for a period of eight years for example (or their hire is renewed).[16] News concerning the introduction of zones reserved for vehicles which do not emit greenhouse gases would also help prevent a rapid depreciation in their value[17]. Finally, grants awarded to firms and vehicle hire companies for acquiring electric vehicles constitute an effective means of stimulating this market.[18] However, EVs with an effective autonomy of 250 km will not come onto the French market in significant numbers before the years 2020-2021.

Electric light commercial vehicles and heavy goods trucks remain very much in the minority

Electric mobility could have been linked to the development of light commercial vehicles, some of which only travel within well-defined areas and thus could be subject to statutory requirements: currently this is not the case. Outside China only 20,000 electric LCVs were sold worldwide in 2017.[19] Their limited autonomy, their high running costs and the limited range of models on sale all act as a disincentive to purchasers. Future restrictions on the movements of the most polluting vehicles in a number of European cities should, however, constitute a boost to sales. Specific financial and tax incentives could be introduced. Moreover, the deployment of heavy goods trucks of up to 20 tonnes (GVWR) by a number of manufacturers around the years 2020-2021 will help to establish the technical and economic viability of these vehicles.[20]

The installation of charging points is a necessary but insufficient precondition for investment in electric vehicles

According to the Ministerial Delegate for the Regional Development of Electro-mobility, the dual objective which could be adopted in France would consist of installing a national average of one charging point per 5-6 vehicles (which was the case in early 2018, with 23,300 charging points accessible to the general public for approximately 150,000 electric vehicles on the roads) and a minimum of one charging point per 10 vehicles in all départements. The provision of quick-charge stations is more problematic. In February 2018, the British equivalent of RTE (National Grid) referred to the installation of 50 ultra-fast charging stations on Great Britain's freeways, directly connected to the electricity transmission grid and supplying up to 350 kW of power for charging BPEVs, LCVs and LHVs.

This constitutes a major challenge for all stakeholders over the next thirty years. We are at an early stage in the installation of the charging points which must naturally go hand-in-hand (without necessarily being strictly proportional) with the use of electric vehicles. However, the number of rechargeable electric vehicles could increase from today's figure of 150,000 to 4.5 million during the next fifteen years, which represents a thirty-fold increase in current numbers. In addition, the recharging power will have to be increased to cope with the increase in battery capacity. In the various countries concerned, government funding is generally involved on a massive scale at first, in particular in terms of the installation of ordinary (so-called slow) charging points; however this contribution then decreases as the private sector takes over. In the United States, after a phase of joint funding from both government and private sectors which began in 2009, the majority of the charging points were financed through electricity companies and automobile manufacturers. In Europe, the Fastned company is developing a network of quick-charge and high-output stations in the Netherlands

14. i.e., the third decile in France: in 2015, 17.1% of households did not have access to a vehicle, www.insee.fr/fr/statistiques/3303447?sommaire=3353488
15. https://droit-finances.commentcamarche.com/faq/3567-smic-2018-montant-mensuel-du-smic; www.insee.fr/fr/statistiques/1375188
16. Except in Iceland, where the limited number of EV models on sale has led to imports of second-hand EVs, and where tourism has led to a significant increase in vehicle hire. See S. Friðleifsson (2017), personal communication, Icelandic Energy Agency, 6 November 2017.
17. Global EV Outlook 2017, IEA 2017.
18. *Reconsidering the Future of Electric Vehicles in Iceland*, AARHUS UNIVERSITY.
19. Where 60,000 light commercial vehicles were sold in 2017.
20. Daimler, Commins, Tesla, Nikola Corp., Renault Trucks.

(without subsidies) and in Germany (with subsidies). Conversely, 18 countries in the EU-28 did not award any grants in 2016 for the installation of charging points, thereby preventing an increase in the use of electric vehicles on their territory. Confronted with this combined private/public sector involvement, from local authorities to the European Commission itself, it is the responsibility of the government to:

- ensure that the rate at which charging points are installed facilitates and keeps pace with an increasing investment in electric vehicles, so as to avoid the phenomena of "charge anxiety" witnessed in Norway (fear of having to queue at charging stations);

- promote private sector funding by removing potential legal and regulatory obstacles (planning, transferability of contracts, etc.) and by making the installation of a certain number of charging points a requirement in the licensing specifications for freeway service stations;

- allow drivers to recharge electric vehicles at any charging point available for use by the general public. The Decree of January 2017 makes this compulsory for new charging points. This requirement has yet to be applied, not only to charging points already in place in France when this decree was issued, but also to all charging points in Europe.[21] In California, this right to free access has been introduced to prevent charging points becoming subject to commercial practices such as requiring drivers to take out a subscription (which would oblige drivers of EVs to subscribe to numerous charging point networks);[22]

- provide financial assistance, following the example of Denmark, the Netherlands and the United Kingdom, for the installation of charging points by request in public areas for households without parking lots;

- provide financial assistance, in conjunction with the authorities concerned and following Tokyo's example, by assuming responsibility for all or part of the installation of charging points in parking lots and garages belonging to apartment buildings, and including social housing;

- generally remove obstacles to recharging at home and at work so as to limit the need to install charging points in public areas.

The examples of Norway and the United Kingdom demonstrate that certain precautionary measures should be taken concerning recharging at home and that the consequences of EVs using electricity distribution and transmission networks need to be anticipated. Regarding recharging at home, a designated outlet is advisable or, failing this, the compliance of the recharging facilities should be checked (the state of the ground). The fires reported in China in electric bus depots during recharging confirm that this risk must be constantly monitored under ICPE regulations (the classification of sites for the purpose of protecting the environment).

Increased investment in electric vehicles should be considered within a more general debate on the future of the power grid

Electric vehicles will put further strains on the management of the grid, but they may also provide solutions. As Norway's example demonstrates, plans to increase the capacity of electricity distribution and transmission networks need to be made well in advance. The ten-year scheme for increasing the capacity of the electricity transmission network, established under the Energy Code, should take into account the possibility of a dramatic increase in the use of EVs by envisaging, for example, that sales of EVs will represent 30% of sales of new vehicles by the year 2030, and by providing a management system that can deal with peaks in demand. But it should also specify the assistance that electric vehicles could offer the grid, not only by responding to demand and adjustments in frequency but also, ultimately, by their batteries' capacity to supply the grid or households with electricity during peak times (as a follow-up to the experiments car-

21. Article 4, Point 9, of Directive 2014/94/EU of the European Parliament and of the Council of 22 October 2014 on the deployment of an alternative fuels infrastructure stipulates that: "All recharging points accessible to the public shall also provide for the possibility of electric vehicle users to recharge on an ad hoc basis without entering into a contract with the electricity supplier or operator concerned".
22. https://www.afdc.energy.gov/laws/11067

ried out in Denmark and in California). Legislation could also oblige the managers of distribution networks to consider the modifications that their networks will require in ten years' time so as to be able to support this development.[23]

The total number of automobiles in the world is expected to be in the tens of millions by 2030, with an annual market valued in the tens of billions of dollars

The European automobile industry, which has a proficient grasp of combustion engine technology, could therefore suffer the loss of a number of jobs as the auto market shifts, even if the numerous studies that have been carried out on this topic have produced different results and show a more positive trend. The key issue at stake is not so much that of finding out whether or not new jobs created in the field of electric vehicle manufacture will compensate for those lost in the traditional production lines; it is more a question of finding out whether the French and European automobile industry will be able to take advantage of the new opportunity that electric vehicles represent. Jobs will in fact mainly depend on market shares and on the added value acquired by the French and European industries, particularly when faced with competition from China which is well-versed in battery technology and currently produces more than half of all private electric vehicles and the majority of—if not virtually all—buses, compact personal commuters and electric bikes.

As the strategy adopted by the UK, China and Germany demonstrates, for France and Europe a boom in the automobile sector and in the employment it provides is dependent on **industrial policy measures which are aimed at promoting electric vehicles**.

- *There needs to be a significant R&D effort*, primarily in terms of batteries but also where new materials, digital technology and recycling are involved. If, in the medium term, the European Union does not manage to produce its own batteries, it will condemn itself to paying out substantial import duties on every car (which would be reduced if the final assembly of batteries was to take place in Europe and if their various cells were to be manufactured in foreign plants located in Europe) and will be dependent on the countries controlling the essential materials.[24] It must therefore provide strong support for R&D regarding next-generation batteries, as part of the Horizon 2020 programme or its successor, through mobilizing resources allocated to societal issues or critical technology, or simply in connection with a European disruptive innovation agency. Without being overly prescriptive of technology, in order to avoid suboptimal choices, it could explore various options (sodium-ion and solid electrolyte batteries, etc.) and have a fall-back plan based on another technology (lithium ion iron phosphate, for example, which avoids dependence on cobalt). Lithium/air batteries could equally constitute an important line of research: advances in this technology (which exhibits significantly greater energy density than is found in existing batteries) would represent a revolution in electric mobility. To this end, the United Kingdom has introduced the *Faraday Battery Challenge*, with funding of £246m over four years.

- *Initial and ongoing training needs to be enhanced* so as to develop the new skills that will be required by the automobile industry, specifically in electronics, mechatronics, digital technology, high voltage management and the new materials.

- *A policy based on demand during the electric vehicle start-up phase* (purchase grants, grants for installing charge points) should be introduced, so that manufacturers will have access to a sufficiently large market to be able to continue to innovate.

  The speech given at the Sorbonne in September 2017 by the France's President on the subject of the European Union referred to a substantial compensatory EU border carbon tax, which would "ensure that those of our manufacturers that are most exposed to globalization are on an equal footing with competing companies and industries from areas of the world which do not have the same environmental standards".[25] A carbon tax of this nature would allow France and Europe to retain a larger proportion of the added value from the manufacture of tomorrow's vehicles and would also provide an incentive for manufacturers to produce their ultra-low emission cars and batteries in ultra-low emission countries.

23. These modifications should reflect developments in renewable energy.
24. See European Battery Cell *Randl* Workshop Final Report, European Commission, 12 February 2018.
25. See the transcript of this speech on the Elysée website.

This same speech suggested "implementing a European industrial programme that supports clean vehicles and provides common infrastructures so that it is possible to travel through Europe without causing any damage". A programme of this kind could therefore consist of two sections: a supply section, which gives priority to R&D initiatives and to training, and a demand section, providing incentives for purchasing EVs and installing universally accessible charging points.

Annual global sales of electric vehicles have now exceeded one million. Even if it is difficult to accurately predict the number of electric vehicles that will have been sold worldwide by the year 2040, the corresponding number of automobiles in the world will represent tens of millions of vehicles by 2030 and an annual market of several tens of billions of dollars. Electric vehicles constitute an industrial opportunity that France and the European Union cannot afford to miss out on.

Key terms: electric vehicle, hybrid vehicle, energy transition, automobile market.

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Press Contact: Jean-Michel Roullé, Director, Publishing-Communications-Events, 01 42 75 61 37, jean-michel.roulle@strategie.gouv.fr