Mission on the automotive industry

Reinforcing the attractiveness and competitiveness of France in tomorrow's automotive industry and mobility

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Introduction

The automotive industry has played a significant role as driver of economy and employment in France over the last decades, as well as in the rest of Europe, for instance in Germany or Italy. Today, the automotive sector in France represents more than 140 000 companies and 800 000 employees over the whole country.

This industry will experience deep transformations in the coming years under the pressure of the environmental imperative, technological evolutions, and changes in consumers' behaviors. Indeed, **tomorrow's vehicles will be clean, autonomous, and shared**. For public authorities and automotive players, these transformations are both challenges and opportunities to be seized.

In this context, the President of the French Republic and the Prime Minister have mandated us to assess the areas in which France could differentiate at global level and to investigate the actions to be taken to both build a competitive advantage for the French industry and attract internationally mobile investments.

As part of this Mission, we have led multiple interviews with decision-makers in the automotive and mobility service industries in France and abroad, mainly in Germany, the United Kingdom, China, and the United States, as well as with representatives of the administrations who are working on the future of automotive and mobility. We have complemented these interviews with market analyses, international benchmarks, and the study of reports from previous assignments. This leads us to come up with recommendations presented in this report, based on an accurate assessment of France's strengths and weaknesses to prepare for the upcoming transformations of the industry.

The first transformation that will impact the automotive world in the coming months and years is the **transition toward cleaner vehicles**. In the first instance, these clean vehicles will be electrified, i.e. electric, plug-in hybrids or hybrids. The electromobility market is already accelerating today. Norway, China, and California notably have experienced a strong development (electric and plug-in hybrid vehicles represented almost 50% of passenger car sales in Norway in 2018). Sales in France are also accelerating, yet the volumes remain modest (2% of sales in 2018).

Because of European rules in terms of CO_2 emissions, the transition toward cleaner mobility should strongly accelerate in France and in Europe in the coming years. The Strategic contract for the Automobile sector, signed in May 2018, sets a goal of 1 million electrified vehicles on the road in France by end 2022. The French government and automotive players are preparing to it. OEMs have announced numerous vehicle launches and investments in production capabilities. Over the last years, the government has led several actions in favor of clean mobility (bonus, charging stations, etc). In order to reach the goals, it is however necessary to reinforce the measures taken, and to lead coordinated actions as of 2019.

The second transformation regards **the arrival of self-driving vehicles**. According to BCG forecasts, self-driving vehicles may represent up to 8% of worldwide sales in 2030 and 7 to 14% in Europe (automation of levels 4-5). Investments of several hundred millions, or even billion Euros have already been made by several players, notably American (Waymo, GM Cruise, Uber, Aptiv), German (Daimler, BMW), and Chinese (Baidu) ones. France has players well positioned

on some key technological bricks, for instance Valeo in sensors. However, French OEMs are lagging behind the leading players in the development of the self-driving vehicle. Encouraging the development of a French or European self-driving vehicle technology should thus be one of the key axes of an industrial policy in favor of automotive for the coming years.

In parallel, the emergence of self-driving vehicles raises a certain number of regulatory stakes that should be addressed, in particular to succeed in the homologation and the certification of this new technology in each of its possible operational design domains[1].

The third evolution regards **the development of mobility services**. All automotive players have created platforms to propose ride-hailing or car-sharing services for instance. Tech new entrants have also taken strong positions in these markets. The emergence of these mobility services meets a strong demand on the users' side: easier, more convenient, faster, and sometimes greener. Self-driving vehicles (levels 4 and 5) should be first developed for urban and potentially shared mobility needs, with major stakes for the automotive value chain. The development of mobility services should thus be further promoted.

These three evolutions are converging, and the 2020's will certainly see large-scale applications of electric, self-driving and shared vehicle fleets in our cities, or even our countryside. France has multiple assets to take a good position in this transformation: public and private R&D, industrial base for automotive and public transportation, engineering talent, productive workforce, dynamic local authorities, proactive public authorities, de-carbonated energy mix, etc. Yet these assets are still scattered and efforts are required to federate them better. In this changing context, reinforcing France's attractiveness and competitiveness has multiple stakes:

- First an economic stake, to attract new players on the territory and stimulate the success of those already present;
- Then a societal stake, so that local authorities and users benefit from mobility solutions: at lower cost, greener, more secured, accessible to all, and better integrated;
- Last an acceptability stake, because these transformations will entail changes in behaviors, and mutations in the industrial base and employment.

In order to succeed, France will have to be able to lead several actions, among which:

- Ensure the presence of an attractive market;
- Offer the regulatory framework to innovate and deploy new solutions;
- Support industrial initiatives;
- Ensure the commitment of industrials engaged in these businesses;
- Support users and sector players.

[1] Operational Design Domain: highways, open roads, large suburban roads, etc

The scope of actions to be taken is broad and at the level of what is at stake. By leveraging these evolutions, France should be able to reinforce its position at the European and global level, and establish itself as one of the **leading countries in tomorrow's automotive industry and mobility**.

Diagnosis and recommendations

1. Make France a leading country in low-emission vehicles

1.1. Create a strong momentum to develop the electrified vehicle market

1.1.1. Context and stakes linked to the development of this market

In a context of reinforcement of the policies in favor of environmental protection and fight against greenhouse gas emissions, the legislation about CO_2 emissions from automotive is becoming more stringent within the European Union. **From 2021, the average of CO_2 emissions for the vehicles sold by each OEM within the European Union must not exceed 95g/km for passenger vehicles, and 147g/km for light commercial vehicles**. As of 2020, the goal must be reached for 95% of passenger vehicles sold already.

For OEMs, this target is very ambitious, despite bonus mechanisms (super-credit[2], eco-innovation[3]) introduced by the European Union in order to help reach the goal. Two main reasons explain it:

- In 2017, passenger cars sold in the European Union still emitted 119g/km on average, slightly increasing versus 2016 (118g/km), as a consequence of the strong increase in gasoline vehicles to the detriment of diesels, on one side, and of the SUV sales increase, on the other side;

- This regulation is simultaneous to the introduction of a new norm for the measurement of CO_2 emissions of vehicles. Indeed, since September 2018, the NEDC norm gave way to the WLTP norm, closer to actual driving conditions. The first estimates show that the emission values measured according to the WLTP norm and translated into NEDC (« correlated NEDC ») lead on average to higher values than those measured with the old NEDC norm, which served as a basis to establish 2021 goals.

Beyond the environmental stake, **the economic stake is a major one for OEMs:** the penalties stipulated are of €95 per gram of excess CO_2 and per vehicle sold. The estimates vary, but indicate amounts that could represent, for players present in Europe, hundreds of millions, or even billion Euros of penalties in 2021, then in 2022, **based on the 2020 and 2021 sales**, if the goals are not met.

In this context, the development of the electrified vehicle market appears as **a major attractiveness and competitiveness stake** within the European Union by 2020-2021. For each OEM, the respect of the emission level target is evaluated based on all their sales in the EU. However, not all European countries have reached the same maturity regarding the transition toward electromobility. As a result, in order to reach their goals, OEMs will have to reach sales above the European average in mature countries such as the Netherlands, France, and Germany.

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[2] Each vehicle emitting less than 50 g/km of CO_2 will receive a weighting coefficient higher than 1 when its emissions will be taken into account in the calculation of average emissions (2 in 2020, 1.67 in 2021, and 1.33 in 2022)

[3] Mechanism that enables to promote the innovations that actually contribute to reduce CO_2 emissions, and whose benefits are not directly taken into account during emission tests

In France, the Strategic contract for the Automobile sector, signed in May 2018, aims at preparing these evolutions. The estimates of the French Automotive Platform (PFA) show that **a fast take-off of electrified vehicles sales (passenger cars and light commercial vehicles) is needed to reach CO_2 emission goals:**

- 100 000 electric vehicles sold in 2020, 135 000 in 2021 (versus 39 200 in 2018);
- 75 000 plug-in hybrid vehicles sold in 2020, 115 000 in 2021 (versus 13 400 in 2018).

These goals represent a strong acceleration of sales: 51% of average annual growth over the 2018-2021 period for electric vehicles (versus 23% over 2013-2018), and 105% over 2018-2021 for plug-in hybrids (versus 76% over 2013-2018). Such acceleration is possible if OEMs and public authorities implement a voluntarist policy. Foreign examples prove it:

- In the United States, electric vehicle sales increased by 123% in 2018, supported by the arrival of the Tesla model 3 in the market and by purchasing incentives;
- In China, electric vehicle sales have increased by 75% annually on average between 2016 and 2018, due to the policy in favor of new energy vehicles (NEV).

Therefore, in some countries worldwide, electrified vehicle sales **now represent a significant share of total passenger car sales**:

Year 2018	**Norway**	**Netherlands**	**China**	**United Kingdom**	**US** (California)	**France**	**Germany**	**Japan**
% of BEVs and PHEVs in total PC sales	48.2%	6.1%	4.4%	2.5%	2,1% (9%)	2.0%	2.0%	1.0%

In the longer term, the European legislation will continue to strengthen, with CO_2 emission reductions of -15% and -37.5% in 2025 and 2030, respectively, as compared to 2021 for passenger cars (i.e. an average of 81g/km in 2025 and 59.5g/km in 2030), and of -15% and -31%, respectively, for light commercial vehicles as compared to 2021 (i.e. 125g/km in 2025 and 101.5g/km in 2030).

In this context of accelerated transition toward electromobility, the Mission recommends to create a **strong momentum in favor of the electrified vehicle** in 2019 in France, and more largely in Europe, in order to enable a significant market acceleration from January 1, 2020. This momentum should rely on **a structured and consistent set of actions to be implemented from 2019.**

1.1.2. Actions proposed by the Mission

1.1.2.1. Act on the offer side: an enhanced range addressing more customers and production capacities ready for acceleration

The transition toward electromobility is first a challenge for OEMs and their suppliers. In a few years, industrials will have to transform in parallel:

- Vehicle offer: the current offer of electrified vehicles is still limited and is considered to be insufficient by more than 85% of the French respondents[4]. For OEMs, the stake consists in **enriching the range in order to attract a broader customer base**, both in terms of use (e.g., compact, family, SUV, battery range) and price;

- Production capacities: investments are required from OEMs and suppliers to ensure the transition from combustion-powered to electric vehicles and enable a **fast ramp-up of production chains for vehicles and components**;

- Commercial strategies: the arrival of electrified vehicles may require the **implementation of new sales mechanisms** (such as battery rental services, used-EV market, or subscriptions to recharge the vehicle at public charging stations for instance) and **accompanying measures for sales networks** (examples: sales pitches, financial incentives).

These evolutions have been anticipated by French OEMs and **are included in their strategy**. For example:

- Range development: PSA has announced 8 plug-in hybrid models and 7 electric models by 2021, and Renault has announced hybrid and plug-in hybrid versions from 2020 for 3 existing models, as well as the commercialization of 8 new BEV models by 2022;

- Ramp-up of production capacities: Renault has announced a 1 billion Euro investment by 2022 in the electric vehicle production in France, and PSA has announced an investment with the Japanese NIDEC for the production of electric engines in France;

- Prices: battery rental has been around for several years to reduce the purchasing price of electric vehicles.

The other major OEMs operating in the European market (BMW, Daimler, FCA, Ford, Honda, Hyundai-Kia, Jaguar Land-Rover, Nissan, Toyota, Volkswagen) are for the most part already present in the electrified vehicle market and are implementing similar plans. Among those, Nissan, Hyundai-Kia, Daimler, and BMW, for instance, have sold about 4 700, 1 800, 1 600, and 1 300 electric vehicles, respectively, in France in 2018. Tesla has sold around 1 250 electric vehicles in France in 2018.

The Strategic contract for the Automobile sector largely takes into account these stakes since French OEMs have committed to develop their range of electrified vehicles and to ensure the attractiveness of this range.

[5] "The mystery of the electric car", published by *L'Observatoire Cetelem* in September 2018

1.1.2.2. Act on the demand side: visibility on the environmental bonus, incentive measures for companies and users, and increased public procurement

The demand for electrified vehicles in France is already a reality. Indeed, sales are continuously increasing from year to year. In France, electric vehicle registrations increased from 9 300 in 2012, to 22 200 in 2015 and 39 200 in 2018. Registrations of plug-in hybrid vehicles have increased from 650 in 2012, to 5 000 in 2015 and 13 400 in 2018.

However, to develop electrified vehicles in the French automotive landscape and to reach the European Union's goals, a strong acceleration of the demand remains necessary. **3 levers can be mobilized to succeed: financial incentives, non-financial benefits and public procurement.**

The financial incentives:

Financial incentive mechanisms are today required to make electrified vehicles economically attractive as compared to combustion-powered vehicles, and still for some more years moving forward - until price decrease (enabled by economies of scale), offer diversification, and public acceptance make these incentives useless.

France has opted for several mechanisms to make electrified vehicles attractive to individuals and companies:

- A fixed bonus for electric vehicles (today set at €6000), re-discussed every year as part of the Finance Law;
- A system of tax exemption on company vehicles[5] (TCV);
- Higher inclusion of the amortization of a vehicle for the calculation of companies' taxable income in case of low-emission vehicles (up to €30 000 base value if CO_2 emissions are below 20g/km and €20 300 if they are between 20 and 60g/km, versus €18 300 for 60-140g and €9 900 beyond that).

These mechanisms seem adapted to stimulate the demand. France **is already one of the most engaged countries in this domain**, the environmental bonus for electric vehicles being one of the first and highest in Europe (see below). Some incentives might however be improved. This is for instance the case of the rules for the lump sum evaluation of the benefit-in-kind related to the provision of an electric company car. Since the evaluation is based on the price of the car and the electrical vehicule more expensive than the equivalent internal combustion engine car, the employee and the company shall respectively pay more income tax and more social contributions.

In order to further strengthen the efficiency of these mechanisms and act more strongly on the demand, the Mission recommends that France sets the financial incentives for the purchase of electric vehicles, for both households and companies, over several years, in

[5] The TCV concerns passenger cars owned or rented by companies – except companies whose main business is passenger transportation *(tax defined in article 1010 of the General Tax Code)*

order to integrate electric vehicle development in their economic tradeoffs in the long term.

Recommendation 1: Set as of 2019 the trajectory of the environmental bonus for electric passenger cars (whose price is lower than €60 000) and electric light commercial vehicles for the three years to come.

Recommendation 2: Maintain TCV exemptions and the maximum based value for depreciation favorable to electric vehicles.

Recommendation 3: From 2019, **adapt the calculation rule of the benefit–in-kind consisting in the provision of an electric company car** in order to neutralize, for the employee who benefits from it, the price difference between electric and combustion-powered models of an equivalent category, and, when fuel expenses are provided by the company, adapt the benefit lump sum evaluation to electric vehicles.

PHEVs are interesting as a transitory solution toward the electrification of vehicle use, since daily trips may be made electrically while being free from the constraints of battery range and charging time inherent to fully electric vehicles. Some OEMs are developing mechanisms ensuring that PHEVs are used in electric mode in the areas with the highest environmental impact, in particular in urban areas.

Recommendation 4: Extending in 2020 the **environmental bonus** to PHEV passenger cars (whose price is lower than €60 000) and light commercial vehicles. This bonus could be conditioned to the introduction of mechanisms ensuring that PHEVs are used in electric mode (some OEMs already have solutions).

Recommendation 5: Extending the **TCV exemption** to PHEV vehicles.

Recommendation 6: Increasing the **maximum base value for the inclusion of amortization** of PHEVs in the calculation of deductible charges for the calculation of the taxable income of companies, in order to reinforce the attractiveness of these vehicles for companies.

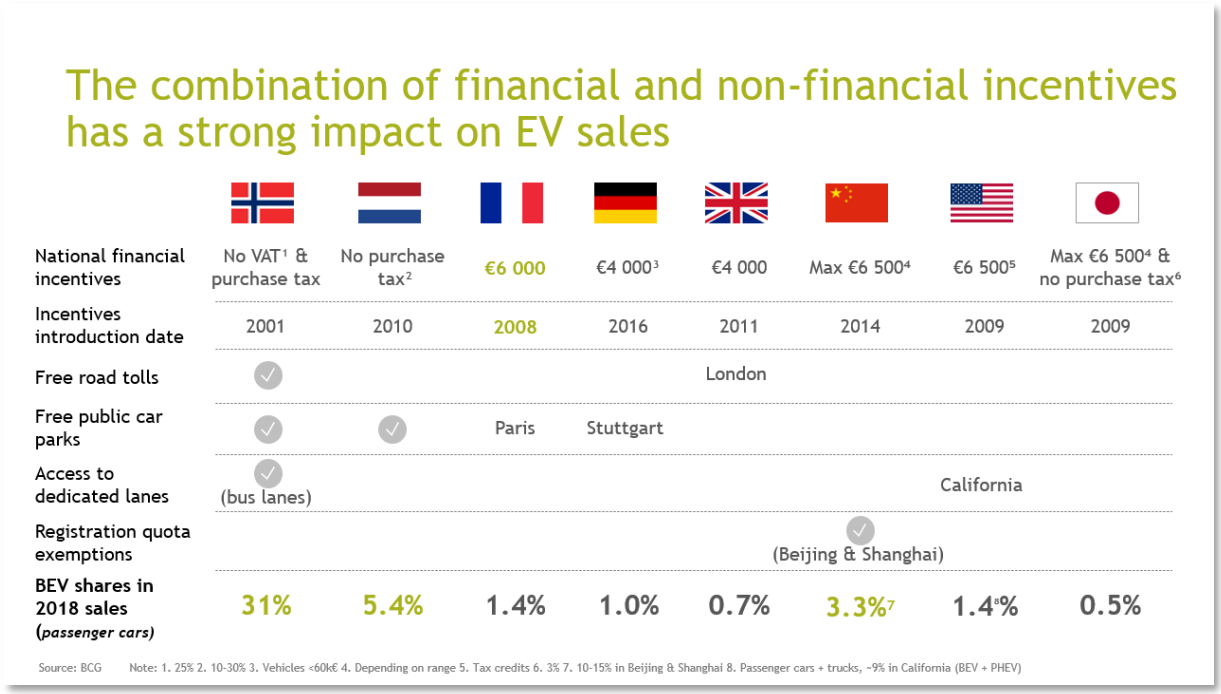
Non-financial benefits:

The countries or regions that have successfully deployed electric vehicle sales have implemented non-financial benefits in favor of these vehicles, in complement to financial incentives. The impact of these mechanisms on market development is significant.

Norway (the European leader in electric vehicle sales[6]) has implemented, for electric vehicles, free road tolls, free parking (with specific parking spaces), and free ferry services, as well as the authorization to use bus lanes in cities. In California, the electrified vehicles, which represent

[6] Electric vehicles represented 31% of passenger car sales in Norway in 2018

about 9% of car[7] sales in 2018, have the right to use high-occupancy vehicle (HOV) lanes. Moreover, numerous American companies offer to their employees free charging of their electrified vehicle at work.



The establishment of low-emission zones (LEZ) is also a benefit in favor of electrified vehicles as they prevent the access, during predefined time slots, of some categories of polluting vehicles:

- France is lagging behind with only 3 LEZs on the national territory versus more than 220 LEZs deployed in Europe today. In September 2018, 15 French local authorities committed to deploy or reinforce a first LEZ (by end 2020);

- The Mobility law (LOM) should give to local authorities the possibility to implement, on large axes, lanes reserved to least polluting vehicles and should ask to all cities exceeding 100 000 inhabitants and those concerned by a PPA[8] to assess the opportunity to launch a LEZ.

<u>Recommendation 7</u>: Facilitate the implementation by local authorities of non-financial benefits in favor of electrified vehicles, and notably:

- Implement or clarify the regulatory and legal conditions authorizing local authorities to deploy such benefits, as already planned in the project of Mobility law presented to the Council of Ministers;

- Support local authorities in the implementation of these benefits, notably for the supervising of the compliance with the measures taken (for reserved lanes for instance).

[7] Passenger cars and light trucks (SUV, pick-up truck, etc)
[8] *Plan de protection de l'atmosphère* (Air pollution plan)

Public procurement:

Public authorities have a significant lever to stimulate the demand for electrified vehicles through public procurement. The State and its operators usually purchase between 6 000 and 8 000 passenger and light commercial vehicles per year (of which ~30% of so-called operational vehicles) while local authorities purchase, on their side, between 10 000 and 11 000 passenger and light commercial vehicles per year from the UGAP[9].

For the ordering of non-operational vehicles under 3.5t, the Law on Environmental Transition for a Green Growth has set **procurement objectives for low-emission vehicles** (below 60g of CO_2/km): **50% for the State and its operators, and 20% for local authorities**. Yet these objectives are not reached:

- Out of ~5 700 non-operational vehicles ordered by the State and its operators in 2018, ~870 are electric ones (**the estimated deficit is therefore equal to ~2 000 units**);
- Out of ~11 000 vehicles ordered by local authorities in 2018 with the UGAP[10], ~1000 are electric ones (**the estimated deficit is equal to ~1200 units**).

According to the State Procurement Department, the main obstacles to the purchase of electric vehicles by the State services relate to 4 areas:

- The range often considered to be insufficient for trips within a region (up to 200 to 300 km in one day);
- The lack of charging stations in administrative site car parks;
- Long delivery and repair lead times;
- The high price, in a context of budget pressure on administrations.

Recommendation 8: Encourage public procurement, notably thanks to 2 levers:

- Reinforce goal-monitoring mechanisms, both at the State and local authority level, with closer monitoring from 2020;

- Improve the charging station equipment in administrative site car parks.

[9] *Union des Groupements d'Achats Publics* (Union of public procurement groups)
[10] Local authorities are not required to purchase exclusively with the UGAP

1.1.2.3. Act on the infrastructure: lift the obstacles to home and out-of-home charging

Among the obstacles mentioned for the purchase of an electrified vehicle, **charging is among the most recurring topics**. The study "The mystery of the electric car", published by *L'Observatoire Cetelem* in 2018, indicates for instance that 86% of French drivers think there are too few public charging stations and 69% that they are not in the right locations. Beyond this network issue, the charging time of electric vehicles is generally considered too long.

Furthermore, **the access to a charging point at home or at work remains limited**. The Electric Mobility Barometer published in 2018 for AVERE France and Mobivia thus shows than less than one out of 10 French people has today the possibility to charge an electric vehicle at home, the same proportion being observed for charging at work.

In order to stimulate market development, charging infrastructure is thus a critical stake. **Two needs should be differentiated:**

- Daily charging: it notably concerns home-work trips and may occur:
    - At home if the owners have a parking lot or a parking place;
    - At work or on public roads if the owners have no parking lot or parking place at home;
- Punctual or complementary charging: it concerns emergencies and stops during long-distance trips (for instance on high-speed roads).

In line with the work of Prefect Vuibert, interministerial coordinator for electric mobility, the Mission has identified **4 levers to encourage the development of charging stations in France**: lift the obstacles to the installation of charging stations at home, lift the obstacles to the installation of charging stations at work, accelerate the deployment of publicly-available charging stations, and facilitate user experience.

<u>Lift the obstacles to the installation of charging stations at home:</u>

In France and abroad, we estimate that more than 80 % of **electric vehicle charging is made with charging stations installed at home**. It is thus essential to ensure an easy and affordable installation of home charging stations. However, even for households that have a private garage, installing a charging point is a costly[11] and complex process (high number of potential contacts, varied offer).

For households in collective housing (44% of French households[12]), the law imposes since 2012 to pre-wire at least 10% of parking spaces for new constructions. For older housing, the law establishes the right to install private charging stations in jointly-owned properties. Yet the process remains complex and uncertain since the procedures are long (3 to 18 months), and the installation costs, which may be high, must be borne by the applicant.

[11] Cost of a charging station, material and labor varies around €1 000 to €2 500, depending on the charging station performances and the electric connection works needed.
[12] According to the study by Insee "*Le parc de logements en France au 1er janvier 2018*"

Financial incentives already exist today to encourage the installation of charging stations at home:

- **Installation works for individuals are eligible to a tax credit mechanism (CITE)**, up to 30% of the costs and within the limit of €8 000 for a single person (€16 000 for a couple);
- **The ADVENIR system,** which notably **covers installation costs up to 50% in collective housing**, limited to €600 for an individual installation (€1 300 for a collective one). This system has been renewed in March 2018 for the installation of 13 700 additional charging points[13];
- Numerous local authorities, including the Paris municipality, grant additional incentives to finance installation works.

Other actions are already taken or planned in order to reinforce the information regarding this issue. Let us mention for instance, in the context of the Strategic contract for the Automobile sector, the creation of a mobile application listing information useful for future buyers or owners of electric vehicles, including information related to the charging issue. The execution of this application is entrusted to AVERE.

In order to reinforce these actions and encourage the installation of charging stations at home in parallel to the accelerated market development, the Mission recommends to lead several actions.

Recommendation 9: **Ensure by 2021 the pre-equipment of new and renovated buildings** as required in the decree of July 13, 2016 and planned in the future Mobility law (LOM), and set up a measure to check the implementation once the works done.

Recommendation 10: Continue the ongoing work to **accelerate the enforcement of the right to install charging stations in jointly-owned properties.**

Recommendation 11: Systematically propose a **packaged offer for charging station installation** at home in OEMs' sales networks, with connection to a provider and upstream negotiation of the price.

Recommendation 12: Create a **governmental website** gathering all the incentives for the installation of charging stations at home, as well as the other incentives for the purchase of electrified vehicles.

Such measures could be completed by the reinforcement of existing financial incentives, such as the CITE tax credit.

Lift the obstacles to the installation of charging stations at work:

[13] This system not only covers charging stations installed in collective housing, but also those installed by companies and public developers

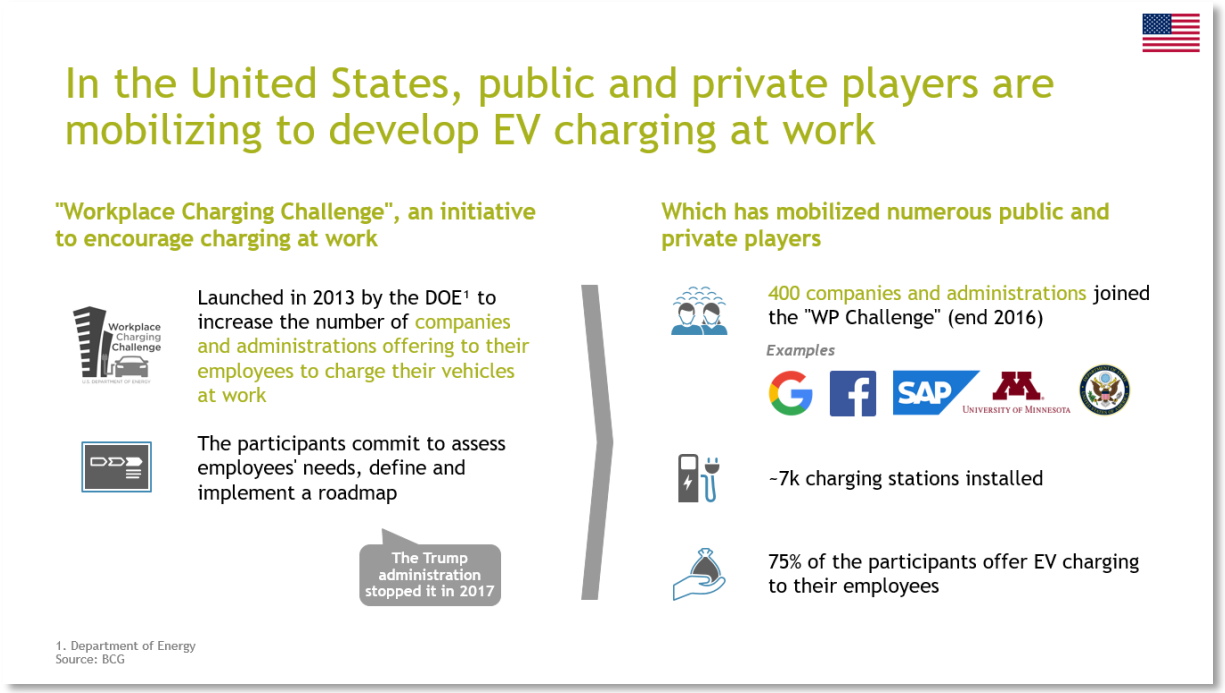
Beyond charging at home, which is not accessible to all (37% of main residences do not have a private parking lot or a parking space in France), the workplace may enable users to have a **daily access to a charging station**.

Today, the procedure is complex for companies wishing to propose vehicle charging at work (for free or not) to their employees, because this is considered a benefit-in-kind that must be precisely evaluated in order to calculate related social contributions and taxes. We think this is inconsistent with the will to strongly encourage electromobility and to simplify its adoption as much as possible.

Hence, to encourage the deployment of charging stations at work, the Mission recommends the following actions.

Recommendation 13: Simplify the provision of charging stations by companies to their employees by opening up, from 2019, the possibility to offer this service for free or as an annual package, by neutralizing, from a fiscal and social viewpoint, this benefit-in-kind.

Recommendation 14: Encourage stakeholders to equip non-residential building parking lots with charging stations beyond existing obligations, both in terms of number and deadline. This could materialize in 2019, for instance through a **challenge around the equipment of companies' and administrations' parking lots with charging stations** along the « Workplace Charging Challenge » model in the United States (see below).



Deploy 100 000 publicly-available charging stations by targeting priority areas and uses:

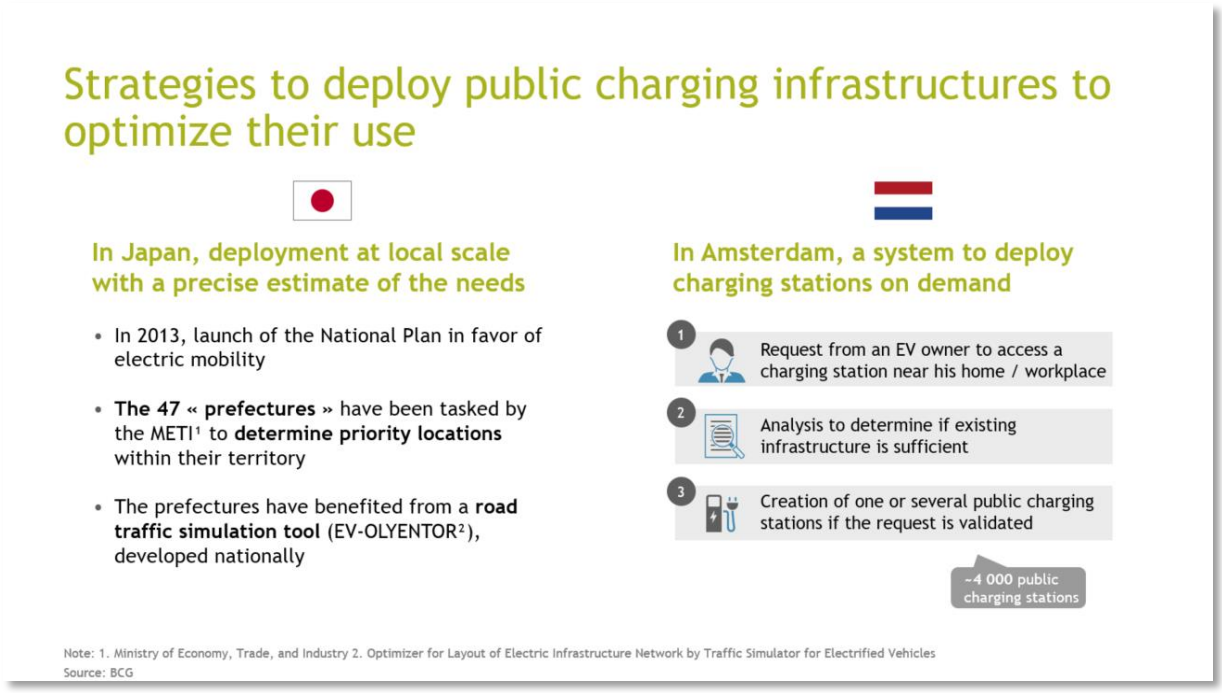
Charging stations **accessible to all** (on the road, in commercial areas, along motorways, etc) should also be deployed to meet the needs of users who do not have access to a charging station

at home or at work, as well as for complementary charging needs (for instance in malls and along motorways during long-distance trips).

The objective of the Strategic contract for the Automobile sector to **have 100 000** charging stations **accessible to the public by end 2022 (versus about 25 000 today) stands within that dynamic**. This would enable to maintain the average ratio of 10 electrified vehicles in circulation for one public charging station, recommended by the European Commission[14].

Numerous local authorities have started to equip **their territory with charging stations**. As of January 1, 2019, local authorities have thus deployed more than 7 000 charging hubs (each hub has several charging stations). The Mission also observes that numerous chain stores, car dealerships or car park companies have already equipped their parking lots or have projects underway (for instance, more than 700 charging hubs have been installed by large retailers as of January 1, 2019).

Beyond their number, charging stations should be installed in strategic locations in order to maximize their use rate. The use rate of charging stations in France is indeed highly variable: while the average is equal to 90 charging sessions per year, the standard deviation is very high, with some highly used stations and others barely used. The Mission has identified several interesting deployment strategies for charging infrastructure, in particular in Japan and in the Netherlands (see below).



Thus, several actions could be considered to accelerate the deployment of charging stations accessible to all.

[14] The Strategic contract for the Automobile sector forecasts a target fleet of one million electrified vehicles by end 2022

<u>Recommendation 15</u>: Continue the ongoing work to **simplify the rules regulating the layout of underground parking lots**, which prevent from installing charging stations today on levels lower than the first basement.

<u>Recommendation 16</u>: Encourage local authorities to **implement experimentations of on-demand charging station systems** (and to co-finance them if necessary), and communicate on pilot projects notably through regional newspapers (for instance, in Saint-Etienne and Calais).

In the future, strategies to deploy public charging stations could follow these guidelines (non-exhaustive):

- Target the areas where the ratio of electrified vehicles per station is high (higher than 7 today for instance) and where collective housing is highly developed (the Paris region for instance);

- Target places that will not be covered by private initiatives, for instance city centers (contrarily to malls where charging stations will probably be offered by chain stores);

- Ensure sufficient granularity in expressway and motorway service station or service area networks;

- Pay attention to fast charging needs (higher than 22 kW) in highly travelled areas; France is lagging behind as compared to Germany and Norway (9% of fast charging in France compared with 16% and 20% respectively);

- Align the development of the charging station network with the anticipated increase in electrified vehicle sales at the regional or departmental scale to maintain a ratio of electrified vehicles per station below 10 (for instance, by taking as a reference the figures of the Strategic contract for the Automobile sector in proportion to today's vehicle sales).

<u>Facilitate user experience for the use of publicly-available charging stations:</u>

The user journey to charge an electrified vehicle **encounters several difficulties today**. An ACOZE[15] study published in December 2018 notably mentions the complexity linked to the multiplicity of mobility operators (and thus of badges to be held) and of tariff bases from one territory to the other. Moreover, charging an electric vehicle may be hampered by the failure of some stations and the lack of real-time information about the reliability of those stations. In short, users who wish to charge their vehicle at a public charging station today are exposed to numerous potential hazards.

In order to smoothen the user journey, the Mission has identified several prerequisites:

[15] *Association des conducteurs de véhicules zéro-émission* (Association of zero-emission vehicle drivers)

- Know exactly where the closest charging stations are, the type of plugs proposed onsite, and their availability;
- Have access to stations in good functioning state and, when a station is not functioning, be informed before going there;
- Be able to easily use all the charging stations whatever the station operator (type of plugs proposed and means of payment).

In order to alleviate these difficulties, the Mission has identified one main action.

Recommendation 17: Ensure, by end 2019, the **publication of a public map** gathering information about the state of charging stations, proposed plug types, real-time information on their availability (based on transport.data.gouv.fr data) and promote it.

The Mission notes that actions have already been taken recently to facilitate public charging station use, in particular with the obligation to make public charging stations accessible to all[16], whose implementation could actually be monitored more closely.

To encourage station operators to maintain a high service level, the obligation to **send to station operators the information escalated by customers** (about the station location, types of plugs available, state of functioning) could be implemented. The implementation of the AFIREV[17] quality label could also be encouraged.

Lastly, ensuring that the 15-118 norm will be published by end 2019 will enable to **reinforce the communication between electrified vehicles and stations** and pave the way for Plug & Charge, smart charging, etc.

1.1.2.4. Sensitize the public to electromobility through the dissemination of an argumentative and precise speech about its benefits

The Electric Mobility Barometer for AVERE France and Mobivia, as well as the study "The mystery of the electric car" by *L'Observatoire Cetelem*, published in 2018, provide valuable lessons on the perception of the electric vehicle in France.

- First lesson: **less than 40% of the respondents think they are "well informed" today about the electric vehicle**, in particular about the use cost, the incentives proposed by the State, and the available range.
- Second lesson: **the image of the electric vehicle is** significantly **deteriorating** as compared to previous barometers, in particular the perception of:

[16] 2017-26 decree of January 12, 2017 regarding charging infrastructure for electric vehicles with various transposition measures of the 2014/94/EU directive of the European Parliament and of the Council on infrastructure deployment for alternative fuels (October 22, 2014)

[17] *Association française pour l'itinérance de la recharge électrique des véhicules* (French association for the roaming of electric vehicle charging)

- Environmental friendliness: about 81% of the respondents consider that it corresponds to the electric vehicle, decreasing by 10 points as compared to 2016 (concerns about the environmental impact of batteries are increasing);
- Economical use: about 68% of the respondents consider that it corresponds to the electric vehicle, decreasing by 12 points as compared to 2016.

- Third lesson: **the intention of purchasing an electric vehicle is rather high** (35% of the respondents) **yet stable** (equivalent level to 2016). The main obstacles mentioned are:

  - Battery range (76% of the respondents would wish more than 300 kilometers of range to meet their needs);
  - Cost, and notably the purchasing price (91% of the respondents estimate that it is higher for electric vehicles than for combustion-powered ones);
  - Access to charging stations (86% of the respondents think there are too few public stations, 69% that they are not in the right locations) and the electric vehicle charging time is considered too long.

These lessons are striking, in particular the significant degradation of the electric vehicle image from an ecological point of view. This perception seems largely related to concerns about emissions from battery manufacturing. It is therefore important to recall, for example, that a study conducted by the *Fondation pour la Nature et l'Homme* in 2017, in which the ADEME participated, showed that the greenhouse gas emissions caused by the manufacturing, the use and the end of life of electric vehicles are 2 to 3 times lower than those for gasoline and diesel vehicles in France today.

Therefore, information disseminated to consumers must be reinforced. Indeed, the electromobility acceleration will not be possible if consumers do not adopt it.

Recommendation 18: **Launch**, end 2019-early 2020, **a large information campaign about the advantages of electrified vehicles**. This campaign could notably cover:

- Elements related to the economy and the environment: actual cost over lifecycle (integrating environmental bonus), battery lifetime and recycling possibilities, CO_2 balance including battery production and recycling, range of the latest electric vehicle models, contribution to the CO_2 emissions reduction, impact on the electricity production and distribution system, etc;

- Driving-related elements: silence during use, driving pleasure (acceleration, smoothness), the modern and responsible image reflected, etc.

This campaign could be simultaneously supported by the State, local authorities, OEMs (in particular in sales networks), NGOs and influencers, and could be deployed on various supports: social media, mainstream media (television and radio), regional daily newspapers, etc.

1.1.2.5. Materialize the momentum in favor of electrified vehicles locally

Several of the actions mentioned above imply **a strong mobilization of local players**: local authorities, charging station operators, automotive dealers, charging station installers, Enedis, companies with parking lots above 20 spaces, companies without parking lot, malls, landlords, property managers, regional press, etc. These players are the indispensable relays to imagine and implement relevant local initiatives, and synchronize them to accelerate the electrified vehicles deployment.

The Mission recommends that some voluntary territories become pilot areas to test the reinforcement and the coordination of various incentive measures in favor of electromobility: accelerated deployment of charging stations, lanes reserved to BEVs / PHEVs, reserved parking lots, local communication campaigns, multiplication of demonstration vehicles, etc. The goal of these pilots would be triple:

- **Observe the impact a joint action of all players might have** and understand the most efficient levers;
- **Build a guidebook of the best practices to be implemented** to accelerate the local development of electromobility (examples: actions with the highest impact, modalities to mobilize private players), which would be then made available to all the local authorities to encourage electric mobility on their territory;
- **Show that electromobility is a credible alternative to combustion-powered vehicles**, once the conditions for success are gathered.

The State could support these initiatives with local pilot authorities, (if necessary) with local project leaders, then draw the lessons and circulate the guidebook presenting the best practices for the local development of electromobility.

1.2. Make a European battery industry emerge and encourage the development of the semiconductor sector

1.2.1. Context and stakes

In the context of a significant development of the electrified vehicle market, batteries and semiconductors, notably those based on silicon carbide (SiC) or gallium nitride (GaN), will represent a growing strategic stake.

The battery industry is currently dominated by Asian players (China, Japan, South Korea), in particular upstream from the value chain (materials, chemistry, cells). Several of these manufacturers, notably Chinese, are supported by a significant local market and public support.

Europe does not have an industrial sector able to compete with global leaders to meet the battery needs associated with mobility. Yet, **mastering this value chain is strategic to secure future supplies** in batteries and capture part of the value created. Indeed, a battery represents on average 30% of the production cost for an electric vehicle, which can be broken down into:

- Mineral ores;
- Powder manufacturing;
- Cell manufacturing (anode, cathode, electrolyte, and separator);
- Manufacturing of the modules, the pack, and its calculator.

OEMs are increasingly manufacturing modules, and above all packs, inside or close to vehicle assembly plants. The battery heart (powders from mineral ores and cells) weights for about 16% of the added value of an average electric car.

In order to succeed in constituting such an industry, France and Europe should rely on European industrial players that are able to **master, collectively, all the battery production steps.**

Furthermore, the increase in electrified vehicle sales in Europe will also entail an increased demand for **power semiconductors**, hence requiring a significant development of the industry (material supply, production capacities, cooperation with automotive players).

1.2.2. Proposed actions

1.2.2.1. Launch the creation of a French and European industry to produce battery cells, able to compete with global leaders

The Li-ion battery cell market is promising. According to BCG estimates, its size is estimated at €18bn worldwide (of which €11-12bn in battery cells for mobility[18]) and, by 2027, it could reach €55bn (of which €45bn in battery cells for mobility). Within this market, Europe could represent 20 to 30% of the battery market for mobility, i.e. **€9 to 14bn**.

Today, the market is dominated by Asian manufacturers, and more specifically Japanese (Panasonic, AESC), South Korean (LG, Samsung), and Chinese (BYD, CATL) ones. These players master the chemistry and cell manufacturing industrial processes, and are planning to settle in Europe to supply the European market (CATL in Germany; LG in Poland; Samsung, SK Innovation and GS Yuasa in Hungary). **On its side, Europe has industrial players that master today part of the technologies required for cell manufacturing**: ores (Eramet, Glencore), chemistry (Arkema, Solvay, BASF, Umicore), cells (Saft, Blue Solutions), and recycling (Umicore, Euro Dieuze/Veolia, Eramet). However, no European industry to manufacture battery cells has been constituted yet, despite that this is a **high value-added activity that represents between 72 and 75% of the final cost of battery packs**.

[18] Vehicles for individuals, light and heavy commercial vehicles

<u>Recommendation 19</u>: Support **the creation of a French and European battery cell production sector**, steered by an industrial player, and mobilizing upstream (ores, chemistry) and downstream players (OEMs and automotive suppliers), as well as European governments, in particular Germany, to pool competencies and investments, and meet European OEMs' needs.

Creating this industry will require:

- Commitments on volumes by several French and German OEMs;
- Large-scale financing (through the IPCEI[19] mechanism);
- Partners upstream from the value chain (ores, chemistry);
- Partners mastering industrial processes: either players that install equipment (Siemens, ThyssenKrupp System Engineering, Jonas und Redmann, Manz AG); or an Asian player already present in the battery market and that could benefit from a partnership with a French player (know-how in chemistry and future technologies, better market access, upstream chain).

A consortium has already been impulsed around Saft, in collaboration with Solvay, Manz, and Siemens notably. The goal would be to build this industrial sector as fast as possible in order to start battery production with the current generation of cells and to lead in parallel R&D works to prepare the arrival of solid-state cells by 2025-30.

1.2.2.2. Secure the supply of critical raw materials for batteries

Among the key ores used in battery production, the mission has focused more specifically on lithium, cobalt, and nickel, each of which is having specific stakes in terms of supply.

For cobalt, estimates indicate an upcoming increase in demand of 9%[20] per year on average by 2030, driven by the development of electric vehicles. **Cobalt issues mainly concern its accessibility**: mines are today concentrated for **more than 65% in the Democratic Republic of Congo** (DRC) and numerous Asian players, notably Chinese, have settled or are trying to settle there. China alone transforms a large part of worldwide cobalt. For France and Europe, securing an access to cobalt should enable to:

- Avoid a situation of dependence on some countries of production (China, Russia, DRC, Zambia, etc);
- In case of access to reserves located outside DRC, defend against possible geopolitical or ethical risks in DRC (the extraction conditions have drawn the attention of international NGOs[21] because at least 20% of the cobalt exported from DRC is extracted in artisanal

[19] Important project of common European interest
[20] In particular BCG estimates
[21] Study by Amnesty International (2017) "Time to recharge: corporate action and inaction to tackle abuses in the cobalt supply chain"

mines, with exploited children who do not benefit from any health and safety protections);

- Protect against potential price fluctuations, a consequence of demand increase.

For nickel, the demand is highly dynamic, driven by stainless steel and batteries for electric vehicles. In the future, the demand is expected to increase by about 5% per year by 2025, according to estimates[22]. **The main issue concerns the ore quality because the production of class 1 nickel**, used for electric vehicle batteries, **might be lower than the demand**. For France and Europe, securing an access to class 1 nickel could enable to protect themselves against price fluctuations due to insufficient supply.

For lithium, the demand is also dynamic, notably driven by electric mobility needs. Today, the market is highly concentrated with four key players, but this concentration should eventually decrease with new projects that should emerge to respond to demand increase. Lithium supply does not present high risks for France and Europe a priori. The market could however face tension (notably on prices) in the short term while new production capacities are established to meet demand.

Beyond the supply issues mentioned above, **the access to key ores is a significant factor of attractiveness for foreign players**. Battery cell manufacturers that wish to settle in Europe value the presence of supply sources of raw materials processed in the countries they are targeting. France could thus benefit from the presence of Eramet to attract foreign investments in the national territory.

In this context, actions could be taken to secure supply in raw materials critical for battery production (nickel, cobalt, lithium). The access to key ores will be a significant element to promote France with foreign industrials positioned in battery production to attract project in the national territory.

1.2.2.3. Support the French battery recycling industry

By 2025-30, recycling should become a significant source of supply for strategic materials for battery manufacturing, **given the volume of electrified vehicles in circulation expected by that time**. Moreover, battery recycling will enable to reduce their environmental footprint and thus to make electromobility even more virtuous. France has already players well positioned on the topic (Eramet, Euro Dieuze/Veolia, SNAM).

In order to encourage the development of this industry, France should:

Recommendation 20: **Support the research and development efforts** of French players in the recycling industry to make it a competitive industry for France.

[22] In particular BCG estimates

1.2.2.4. Encourage the development of the European industry of semiconductors

The increase in electrified vehicle sales will entail an **increased demand for power electronic components, such as converters and inverters, requiring power semiconductors.** Current electric vehicles contain about ten times more semiconductors than conventional combustion-powered vehicles.

Europe has well-positioned players on SiC semiconductors with, for instance, STMicroelectronics and Infineon Technologies. Exagan, a company stemmed from the CEA, is developing an expertise in the power semiconductors based on gallium nitride (GaN). Other players are located upstream from the value chain, such as SOITEC in France, a global substrate player.

To support the upcoming development of electric vehicle production, it is important to make sure that sufficient production capacities of power semiconductors are put in place to meet the demand for electrified vehicles by 2-3 years. **The cooperation between SiC and GaN European players** regarding the control of material supply could also be encouraged.

Simultaneously, it is necessary to organize the cooperation between the automotive and microelectronics industries so that the microelectronics sector is identified as strategic by automotive players and to better structure the collaboration between both industries.

1.3. Support the industrial transition toward electromobility

1.3.1. Context and stakes

The transition toward electrified vehicles will cause a gradual market loss for the industrials currently positioned on the supply of parts and components for combustion-powered vehicles (such as, for instance, high-pressure injection nozzles, pumps, or catalysts).

While OEMs and large suppliers (Tier 1) may mobilize resources (financial, technical, human) to ensure the transition of their offer and production means, as well as the redeployment of their employees, **some French SMEs could face difficulties in the short and mid-term.**

The UIMM[23], as part of its study about the impact of automotive mutations on employment and skills (published in November 2018), has identified **336 industrial plants and almost 38 000 jobs concerned** by the diesel decrease and the increase in electrified engines.

The automotive sector (OEMs, large suppliers, PFA) and public authorities should support these companies and their employees.

1.3.2. Proposed actions

In order to ensure the industrial transition toward electromobility, in particular for Tier 2 suppliers, the Mission recommends the following actions, already largely initiated by the PFA:

[23] *Union des industries et métiers de la métallurgie* (Union of metallurgy industries and businesses)

Recommendation 21: Support suppliers and subcontractors (Tier 2) in their conversion toward electric mobility, especially for OEMs and large suppliers (Tier 1).

Recommendation 22: Monitor the evolution of sensitive industrial sites.

Recommendation 23: Financially support industrial site conversion actions.

Recommendation 24: Financially support employees' redeployment actions.

1.4. Prepare the alternative technologies that should contribute to environmental transition in the longer term

1.4.1. Context and stakes

The Mission has identified other technologies of interest for industrials and public authorities, as they represent potential opportunities in terms of clean vehicles in the mid- and long term.

Some of these technologies (« vehicle-to-grid », charging by induction, battery swap) enable to reinforce the environmental and economic interest of electrified vehicles, by optimizing the battery use and limiting their current constraints in terms of range and charging time. Other technologies (hydrogen, biofuels) are alternatives to electric and plug-in hybrid vehicles to reduce CO_2 emissions due to road traffic.

1.4.2. Proposed actions

1.4.2.1. Investigate the potential of "vehicle-to-grid", notably in terms of business model

« Vehicle-to-grid » (V2G) is the technology that enables to reinject into the network the power stored in vehicle batteries. The idea is to be able to feed the power grid depending on the needs. V2G has several interests in terms of environment, energy, and economy:

- From an environmental viewpoint, this technology enables a better penetration of renewable energies by making the storage of potential electricity surplus possible;
- From an energy viewpoint, V2G provides flexibility to the power grid and enables to smoothen very costly consumption peaks;
- From an economic viewpoint, V2G could reinforce the interest of electric vehicles by providing to their owners an additional income source for having stored then supplied electricity to network.

<u>Recommendation 25</u>: Create a working group (with RTE, DGEC, CRE[24], Enedis and OEMs) to refine the understanding of the benefits and challenges linked to V2G, investigate the « vehicle-to-grid » potential, and define a deployment plan as needed.

1.4.2.2. Investigate the potentials of charging by dynamic induction and battery swap

Beyond fast-charging stations, two charging options for electric vehicles for long-distance trips have been examined by the Mission:

- The first one consists in powering electric vehicles by electromagnetic induction (thus without contact) while driving. This requires inserting flat coils under the roads, powered by power electronic boxes on the side. Tests enabled to validate the attainment of a recharging power from 20 to 25 kW for a vehicle moving at 130km/h, i.e. what a sedan consumes at that speed[25]. The objective is not to eliminate the vehicle battery, but to increase electric vehicle range on motorways;

- The second option is battery swap, a system that consists in replacing in 3-4 minutes the discharged battery of an electric vehicle with another charged battery, rather than waiting 15-20 min at a fast-charging station (partial recharging).

Using these technologies may reinforce the adoption of electric vehicles, since they limit current constraints linked to charging time, and make 100%-electric long-distance trips possible. Moreover, they could enable to reduce the overall environmental footprint of electric vehicles by limiting battery ranges, hence battery sizes. **However, these technologies are not mature and their interest should be confirmed.** For instance, battery swap seems to be a difficult solution to implement: it implies reaching a high level of standardization among OEMs and being able to continuously manage battery availability and charging. Despite this, this technology is used for some bus fleets in China as well as, more recently, by the Chinese OEM Nio for some cars.

<u>Recommendation 26</u>: Create working groups, in collaboration with DGITM, VEDECOM, operators of road infrastructures (such as Vinci Autoroutes, Sanef and APRR) and OEMs, to investigate the potentials of charging by induction and battery swap, understand related challenges, and define, as needed, a deployment plan including pilots.

1.4.2.3. Build a roadmap for a clean and affordable hydrogen mobility

The modern hydrogen vehicle is an electric drive-train vehicle, whose battery is replaced with a hydrogen tank and a fuel cell that produces the required power for the engine. This technology has real benefits for mobility, **mainly for intensive uses.** Indeed, hydrogen vehicles benefit from a high autonomy and low charging time: battery range between 500 and 600 kilometers,

[24] Commission for Energy Regulation
[25] The consumption of an electric SUV at this speed would be higher, around 30 kW.

depending on the tank capacity[26] (versus 300-400km for electric vehicles such as Renault Zoé or Nissan Leaf) for a charging time between 3 and 4 minutes. Therefore, they have characteristics rather similar to combustion-powered models in terms of autonomy and charging time, while emitting zero CO_2 emission on a tank-to-wheel basis.

From an environmental and economic point of view however, hydrogen doesn't seem to be a competitive solution for mobility yet:

- The CO_2 footprint of hydrogen produced by steam reforming from fossil gas (41% of the French production), by partial oxidation of hydrocarbons (40% of the domestic production) or by coal gasification (14% of the domestic production) is rather high: CO_2 emissions on a well-to-wheel basis are of about 130 to 230g/km[27] for a sedan;

- For a significant improvement of the CO_2 footprint of a hydrogen-powered car, the hydrogen should be produced by water electrolysis (5% of the domestic production today, mainly used by the chemical industry). Yet the energy yield of the full chain (electrolysis – compression – transportation - compression at 700 bars – fuel cell) is then lower than for a battery (charge-discharge), and the cost is high. Another de-carbonated solution with a better energy yield could come from steam reforming with CO_2 capture and storage. Yet the availability of this solution at an acceptable cost by the automotive industry is far away;

- De-carbonated hydrogen vehicles have a higher cost of ownership than other mobility solutions, including electric vehicles. Estimates by the Hydrogen Council[28] thus forecast that the total cost of ownership of hydrogen-powered vehicles will remain higher than the one of electric vehicles for several years to come.

Other obstacles, exogenous to the technology itself, may hinder hydrogen development as a mobility solution in next few years:

- Specific vehicle architectures should be designed then industrialized to integrate the cylindrical and large hydrogen tank and the fuel cell system;
- An infrastructure network (distribution and charging stations to power vehicles) should be deployed on the whole territory, and financed. This logistic chain is costly since hydrogen is a hazardous gas in presence of oxygen, and its storage and transportation modes are regulated by strict security rules.

If the Mission recognizes the technological interest of hydrogen, it does not consider that this solution will be the key lever to lower the environmental footprint of passenger cars in the short

[26] For instance, Toyota Moira has two cylindrical tanks, each of which has a capacity of 60L. Moira autonomy is 500km.

[27] 10kg to 20kg of CO_2 per kg of H_2 enabling to travel 100km, excluding battery impact,in the "*Plan de déploiement de l'hydrogène pour la transition énergétique*", report to the Minister of Environmental and Solidarity-based Transition, written by the CEA and DGEC, in concertation with economic and institutional players of the French hydrogen sector.

[28] Initiative launched in 2017, in Davos, as part of the World Economic Forum. A recent study by Faurecia shows that the long-term cost announced by Shell for de-carbonated hydrogen (€3/kg) would enable to be competitive in terms of total cost of ownership as compared to electric vehicles for vans or D/E crossovers.

and mid-term. To prepare a longer-term strategy, the "new energy systems" sector and the PFA could establish a detailed roadmap for 2030-35 for a clean and affordable hydrogen mobility, with commitment of the relevant players. Beyond automotive, decarbonized hydrogen could be promising for heavy vehicles, on road as for rail.

1.4.2.4. Continue the effort to support the biofuel industry

Biofuels represent 4% of the energy consumed by transportation worldwide today. Very far behind Brazil and the United States, France is the 1st producer and the 1st consumer of these fuels in Europe. This represents 20 000 and 9 000 jobs (biodiesel and ethanol).

Gains in CO_2 emissions are substantial: -50 to -60% (biodiesel), -70% (beet ethanol, even better with sugar cane) on a tank-to-wheel basis, as compared to combustion-powered vehicles.

According to the elements presented by the IFPEN[29], advanced biofuels are even more efficient: ~85% (ethanol) and ~90% (biojet/ kerosene). Developed in France since 2008-2010, the Futurol (ethanol) and BiotFuel (biodiesel and biojet) do not consume products in competition with food anymore, but straw or forest residues, and are ready for industrialization. Yet calls for projects, to date, occur outside France (17 versus 0). India already has 12 projects underway.

Biofuel production could however be absorbed first by aviation, which has no other solution to date to reach the goals of greenhouse gas emission reduction by 2050; the eventual potential for automotive should thus be evaluated. To do so, a common roadmap for France on biofuels could be established by associating the three sectors concerned: energy systems, automotive and aeronautics.

Depending on the eventual potential identified for automotive, the opportunity of taking into account biofuel use in the calculation of CO_2 vehicle emissions and the definition of related objectives will have to be explored.

2. Development of self-driving vehicles: a French leap is required

2.1. Context and stakes

Self-driving vehicles (passenger car, robo-taxi, shuttle, robo-bus) are a promising market for the automotive industry. According to BCG forecasts, autonomous vehicles may represent up to 8% of worldwide sales in 2030 and 7 to 14% in Europe (automation of levels 4 and 5).

The self-driving applications for privately owned passenger cars will first come through the high-range segment, in which French manufacturers are not very active, and will first represent moderate volumes.

Conversely, **autonomous on-demand shared transport services** (robo-taxis of 3 to 12-15 seats) as well as **autonomous freight transport services** should be the first ones to massively

[29] *Institut Français du Pétrole Energies Nouvelles* (French Institute of Petroleum New Energies)

develop (the driver cost saved enables to offset the cost of the self-driving system). Waymo, Google's subsidiary dedicated to self-driving vehicles, has pre-ordered more than 80 000 cars to that end for 2019-2021, thus leading the way. It is hence a critical stake for the French automotive industry.

The Mission has observed that French players are lagging behind regarding the development of self-driving vehicles as compared to American, German, and Chinese industrials. German OEMs, more mobilized than their French counterparts, are however still behind the leader, Waymo, considered as a threat in Germany, and maybe also behind GM/Cruise.

Waymo has accumulated self-driving tests (more than 16 million kilometers driven to date), which has enabled the company to detect more than 20 000 different driving situations. Exploiting these data thanks to machine learning techniques, a domain in which its parent company, **Google**, is a global leader, enables Waymo to improve recognition and decision-making programs. The company also massively uses simulations to that end, with more than 10 billion kilometers virtually « driven ». It is also conducting tests in more than 25 cities in the United States. This has enabled them to use their self-driving vehicles for on-demand transportation of volunteers in Phoenix (Arizona) for more than one year, sometimes without safety driver. They obtained in October 2018 the authorization to do the same in California.

General Motors and its subsidiary Cruise, which has received more than $4bn of financing agreements from SoftBank and **Honda**, is conducting tests on open roads, including in San Francisco, a city considered as difficult for self-driving vehicles. Their budget is close to $1bn per year and they employ 2 000 people, including the staff dedicated to adapting the GM Bolt to automation.

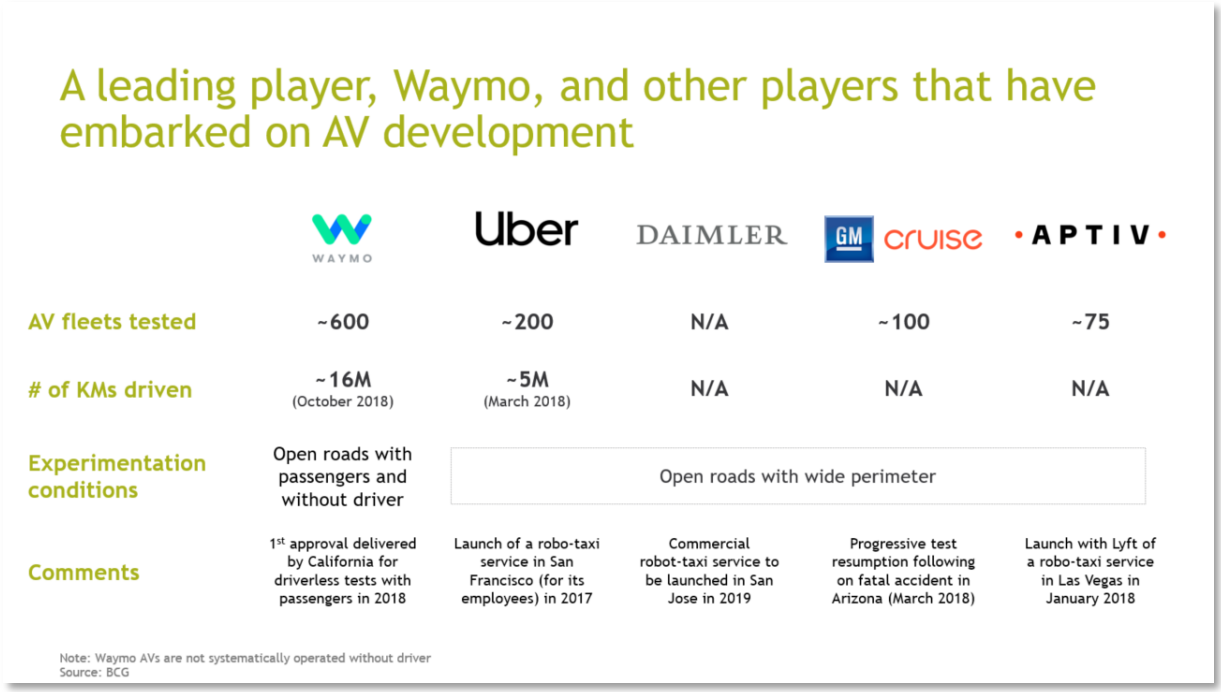
Daimler and Bosch employ more than 1 500 people for their joint development of self-driving vehicles of levels 4 and 5. They are testing autonomous vehicles on open roads in Germany and the United States. **Bosch** announced to employ 4 000 engineers working on areas related to autonomous driving and is planning to dedicate €4bn by 2022 to that end.

The supplier **Aptiv** (formerly Delphi) has around 70 self-driving vehicles in Las Vegas for commercial services with safety drivers, in collaboration with Lyft. The company has several hundred developers dedicated to self-driving vehicles, after having acquired Ottomatica in 2015 and NuTonomy in 2017. **Uber and Continental** have entered the same race to develop the full system required for self-driving. **Valeo** focuses on sensors (first player to have introduced lidars in the mass market) and ADAS systems (Valeo is one of the global leaders). The company allocates 40% of its R&D budget to them.

Ford with Argo.AI, **BMW, Renault-Nissan, Toyota,** and **Volvo-Geely** with Zenuity (its joint subsidiary with Autoliv) are also developing their own self-driving vehicle technology (levels 3, then 4 and 5). They seem to be, to date, at an earlier stage of development than the other players mentioned above.

Some start-ups, mainly in the United States, are tackling the complete system, yet with lower resources (Zoox, Aurora, Drive.ai, Pony.ai, Roadstar.ai, with Chinese participation for the two last ones).

China has implemented an original development scheme, with a central role played by **Baidu** and its **platform Apollo**. This platform gathers components, software elements, Baidu's HD mapping, a database of driving situations, and integrates about a hundred partners, OEMs, component manufacturers (including **Valeo, Intel, Kalray, Velodyne**), AI and machine-learning specialists, all kinds of start-ups, etc. Chinese companies are particularly present on the platform, and the means deployed are significant, even if visible signs of progress are limited.



In response, French resources are low and scattered. Several factors contribute to this situation. The main ones are:

- Limited R&D investment from French OEMs, notably due to the necessity to dedicate significant resources to reducing the CO_2 emissions of their range;
- The late introduction of a regulatory framework encouraging experimentations of self-driving vehicles in France;
- A regulatory approach that does not enable to consider the commercialization of some level-2[30] self-driving vehicles nor those of levels 3-5 in France and in Europe; future exemptions should nevertheless enable the commercialization of the most advanced level-2 systems and the level-3 ones in the coming months.

[30] Only low-speed automatic parking (<12km/h), lane-keeping assist, lane-changing assist and collision avoidance systems can be commercialized today in the EU

However, France has assets on which to rely to accelerate:

- **Players that master key technologies**: Valeo (world-class supplier of components for self-driving vehicles), two national players in low-speed shuttles (EasyMile and Navya)[31], and middle-sized companies or start-ups in deep tech and software;
- **Skills in AI and « certifiable » AI** in aeronautics and rail, notably from INRIA, CEA LIST, IRT SystemX, 3IA institutes and DataIA;
- **Public voluntarism**: the publication of strategic orientations of public action for the development of self-driving cars by the Senior Head of the National Strategy for the Development of autonomous vehicles, Anne-Marie IDRAC, the law Pacte, under review by the French Parliament, which should enable to facilitate self-driving vehicle experimentations; the project of Mobility law which includes provisions on the circulation of self-driving vehicles and shuttles; the call for projects EVRA[32] by ADEME provided with €40m, etc.

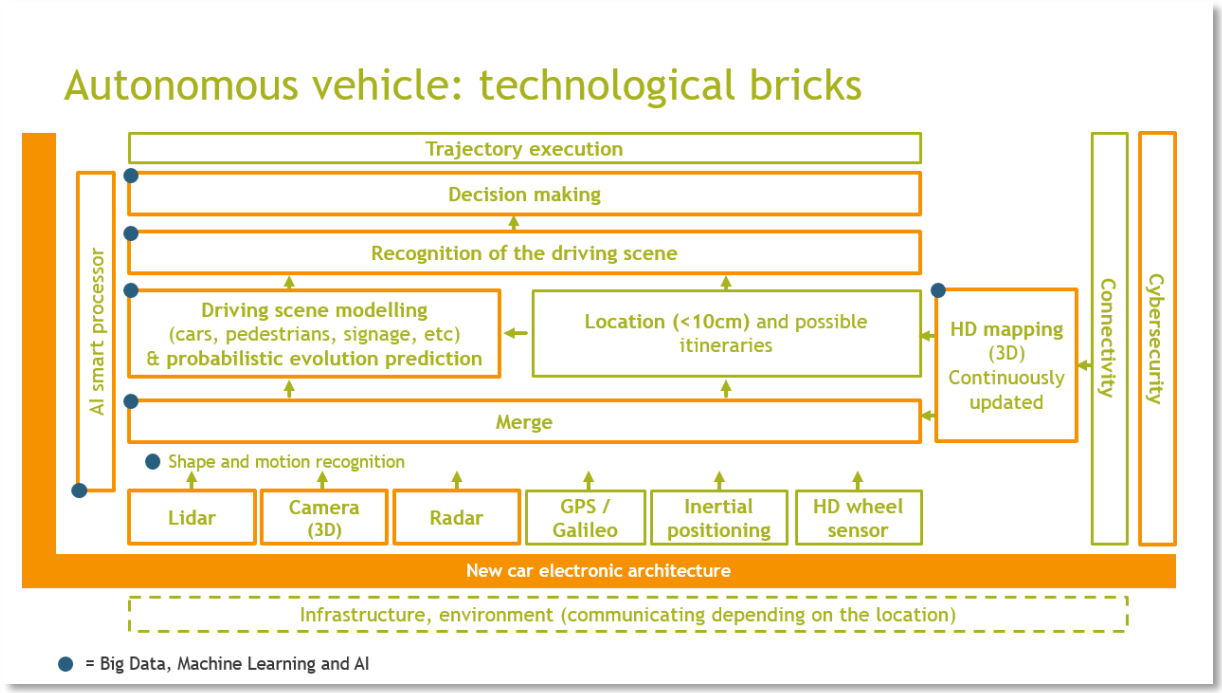
2.2. Numerous technologies to be mastered for self-driving vehicles

Multiple technologies are required to design, manufacture, then operate a self-driving vehicle, of which many are still in fast evolution: sensors (camera, radar, lidar), multicore processors, AI software partially educated by machine learning based on the data recorded during millions of kilometers driven, HD mapping, precise positioning (by satellite, by triangulation.), etc.

Moreover, even before the first driving test, other technologies are used, in particular to:

- Build and maintain HD mapping, possibly 3D;
- Search for waypoints for the positioning by triangulation;
- Run driving simulations in a digital environment that finely reproduces the reality under varying conditions (light, rain, fog, traffic, wiped horizontal signage, pedestrians, cyclists, animals, etc), and introduces critical driving situations to virtually test the vehicle on the ground chosen (« software in the loop » or even « hardware in the loop » if the detailed functioning of sensors is known).

[31] Lohr, often mentioned, does not develop software
[32] *Expérimentation du véhicule routier autonome* (Experimentation of the self-driving road vehicle)



France has also significant research resources that the national strategy for artificial intelligence has decided to group within Artificial Intelligence Interdisciplinary Institutes **(3IA).** Among the 4 ones selected, those of **Toulouse** (ANITI) and **Paris** (PRAIRIE) have included AI for transports (aeronautics, rail and automotive) in their domains of research and competencies.

ANITI in Toulouse, for instance, gathers teams from LAAS, IRIT, IRT St-Exupéry as well as **Airbus, Thalès, Continental,** and **Renault**. In particular, IRIT is working on « explainable and certifiable AI », a key element for self-driving vehicles on open roads. Several projects are common with the Aerospace Valley competitiveness hub.

DataIA (Institute of data sciences and AI) in **Saclay** also gathers numerous AI players[33] and has included mobility among its 3 objectives.

Lastly, **IRT SystemX** is focusing on « technology transfer » toward and with companies of all industries (above all aeronautics, automotive, rail and energy).

Yet these resources remain scattered and are only federated as part of academic frameworks or collaborations, not for operational projects dedicated to self-driving vehicles.

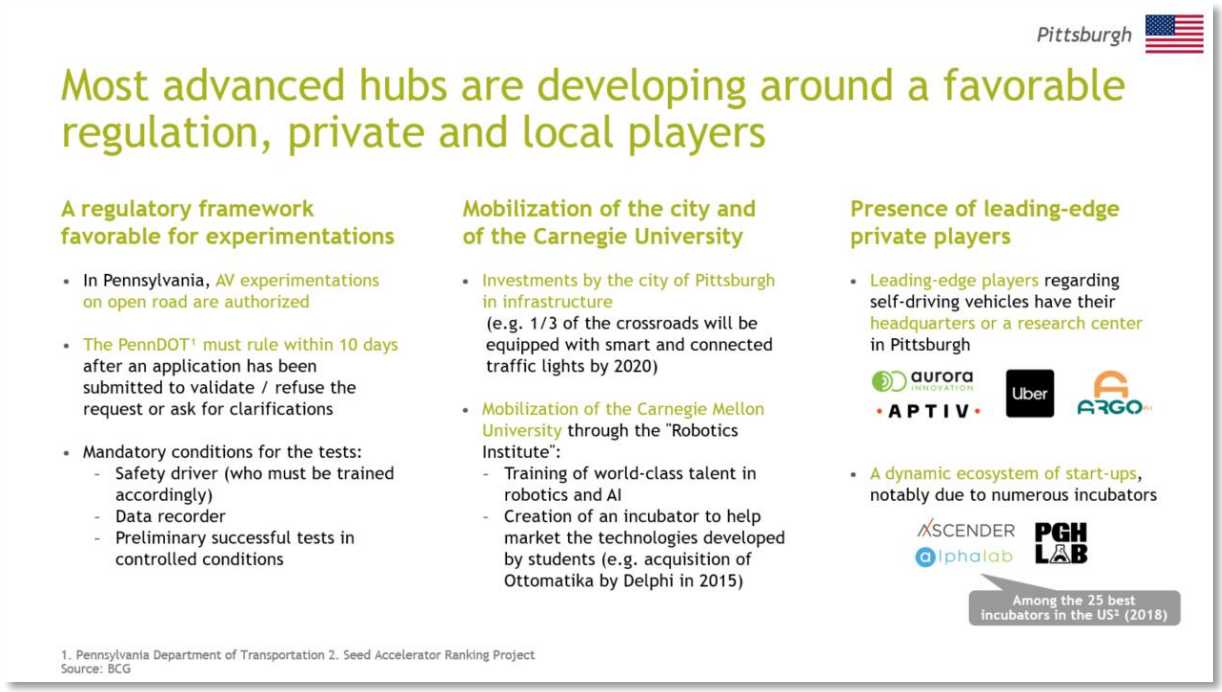
2.3. The importance of local hubs

In the United States, three major self-driving vehicle hubs prove the interest of **concentrating public and private resources** in a same place:

- The Silicon Valley, with its unique electronic and software ecosystem, Stanford and Berkeley Universities;

[33] Renault, Thalès, Airbus, Total, Enedis, AXA, CEA, CNRS, IFPEN, INRA, Inria, ONERA, Paris Saclay University and engineering and business schools of the Saclay plateau: X, ENSTA, HEC, CentraleSupélec

- Boston and the MIT;
- Pittsburgh, where an ecosystem has been built around the Carnegie Mellon University and its leading robotics lab, which has been the original source of Waymo, Uber, and Aptiv teams, the last two having each a development center onsite.



In France, **Toulouse** and the **Paris** region would be two obvious **hubs to be better federated**.

2.4. Proposed actions

In order to reinforce France's attractiveness (and attract investments linked to the development of self-driving vehicles in the territory) and French players' competitiveness, the Mission has identified six main levers:

- Accelerate the development of self-driving vehicle technological bricks by French players;
- Federate the major players around a common self-driving vehicle platform;
- Obtain a common French-German database of driving data and critical driving situations;
- Encourage the experimentations of self-driving vehicles in France;
- Accelerate the definition of a regulatory framework for the certification and homologation of self-driving vehicles in Europe and in France;
- Create the conditions for the social acceptability of self-driving vehicles.

2.4.1. Accelerate the development of self-driving vehicle technological bricks by French players

Following the observation of the lateness of French players in developing self-driving vehicle technologies, detailed above, the Mission recommends:

Recommendation 27: Create and manage a list of French start-ups and middle-sized companies positioned on the bricks required for self-driving vehicles and circulate it to automotive industry integrators (OEMs, Tier 1 suppliers).

Regarding Artificial Intelligence, **French skills in "verifiable and certifiable" AI could be developed**, for instance by mobilizing the "AI big challenge". This would enable both to support the major players in self-driving vehicles and certification bodies (see 2.4.4).

Skills in « software in the loop » simulations are also crucial for the validation, homologation, and certification of self-driving vehicle software platforms; their development should be supported and directed to meet the needs of players that undertake the development of such platforms. To that end, encouraging French players (AV Simulation, ESI, IRT SystemX, Inria) to federate could be relevant.

Regarding mapping, in order to fill the gap in HD mapping, it could be useful to **investigate the need to equip France with a high-definition mapping technology** for self-driving vehicles, as German players have done.

2.4.2. Federate major players around a common self-driving vehicle platform

French OEMs and mobility players are more specifically lagging behind in two key elements for the development of self-driving vehicles:

- The embedded **software platform**;
- **Driving data** (see 2.4.3).

Waymo and the main American and German autonomous vehicle players develop their own platforms, which **mobilizes considerable resources**: several hundreds of people, trial vehicle fleets, significant driving tests, budget of hundreds of millions of dollars.

In China, the government has encouraged a more collaborative approach. Indeed, Baidu, Google's Chinese competitor, is developing an « open » platform that gathers validated and characterized components as well as software stack bricks, that are increasingly numerous. The partners of the platform can use these elements and integrate them into their own solution: it is the case of Baidu, as well as of other players, such as Chinese autonomous shuttle manufacturers.

In Japan, an « open source » platform, Autoware, was launched notably with Nagoya, Tokyo and Stanford Universities, Open Robotics, Intel, LG and Kalray. More than 30 cars are equipped with Autoware and are authorized on open roads in Japan.

The German OEMs met as part of the Mission are aware that lagging behind Waymo is a risk for the future, and are open to a cross-manufacturer collaboration, notably with French OEMs.

In order to fill the technological gap of French and European players in mastering the software stack of self-driving vehicles, the Mission recommends:

Recommendation 28: Encourage a get-together of French and German OEMs interested in mastering the self-driving vehicle software stack within an operational structure.

2.4.3. Obtain a common French-German database with driving data and data on critical driving situations

Waymo has accumulated the largest amount of driving data (~16M kilometers announced in October 2018 and presumably ~20M kilometers in February 2019 given the current pace) and announced to have more than 20 000 driving situations in its databases. Its expertise in machine learning and deep learning gives Waymo a significant advantage on European OEMs.

In France, initiatives have been launched to constitute driving databases, including in collaboration with German players (Pegasus project). However, the outcomes are still little conclusive, and few data have been shared. A strong revival is thus required.

Recommendation 29: Create a **common database of driving situations** for the development of self-driving vehicles **at French and German levels** in order to get closer to the data volumes collected by leading players. The first step could be, with the impulse of both governments, to ask French and German OEMs to propose a common approach (which data to share, with which standards, which driving means, and which driver?)

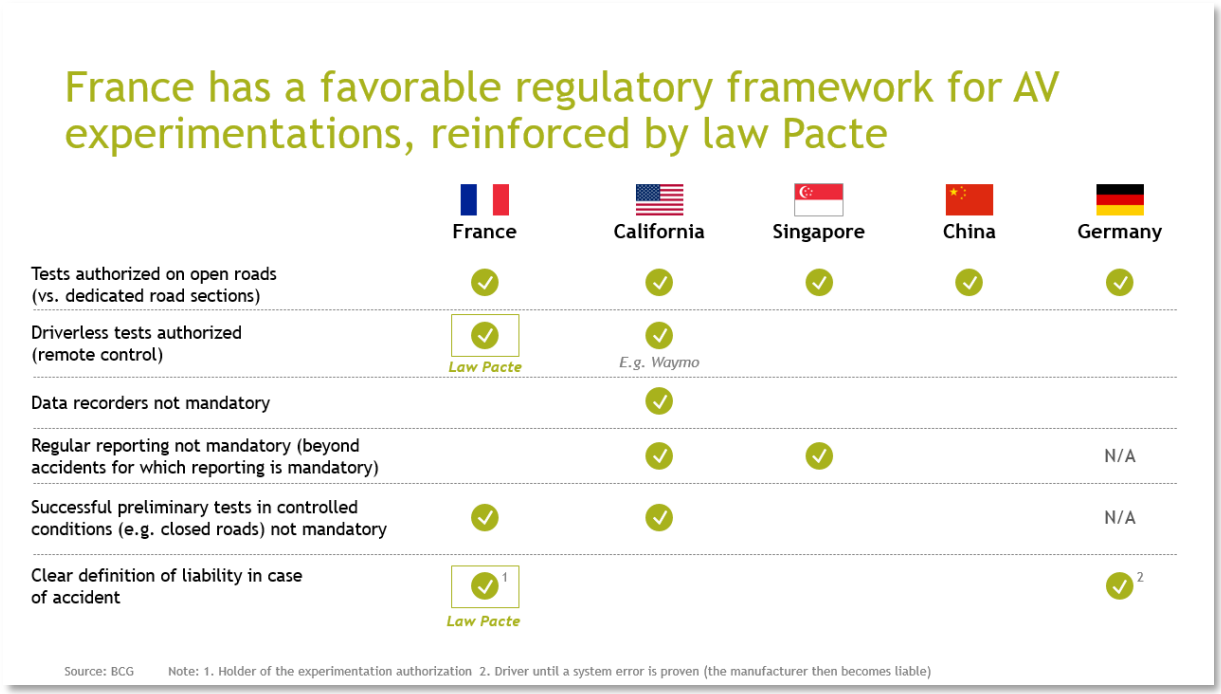
From this common database, driving situations could also be extracted to be used for the homologation and certification of self-driving vehicles in Europe by simulation or physical trials for a more limited number of well-selected cases (see 2.4.5).

2.4.4. Encourage self-driving vehicle experimentations

A regulatory framework encouraging self-driving vehicle experimentations is a significant factor to attract investments (in particular for research centers dedicated to self-driving vehicles) and to reinforce the competitiveness of the players present in the territory.

France has implemented a regulation encouraging these experimentations quite late as compared to the United States (California, Arizona, Pennsylvania, Michigan, etc). Yet in March 2018, the decree on the experimentation on public roads of vehicles with delegated driving has authorized the circulation of autonomous vehicles on open roads for experimental purposes (rather than on well-defined road sections).

Moreover, **the law Pacte and the Mobility law should enable France to be positioned among the most advanced countries worldwide regarding self-driving vehicle experimentations** by opening the possibility to conduct tests without safety driver.



<u>Recommendation 30</u>: Continue the work to simplify the regulatory framework regarding the experimentations of self-driving vehicles, by identifying potential additional simplification options based on the feedbacks from ongoing projects.

2.4.5. Accelerate the definition of a European regulatory framework for the certification and homologation of self-driving vehicles in Europe and in France

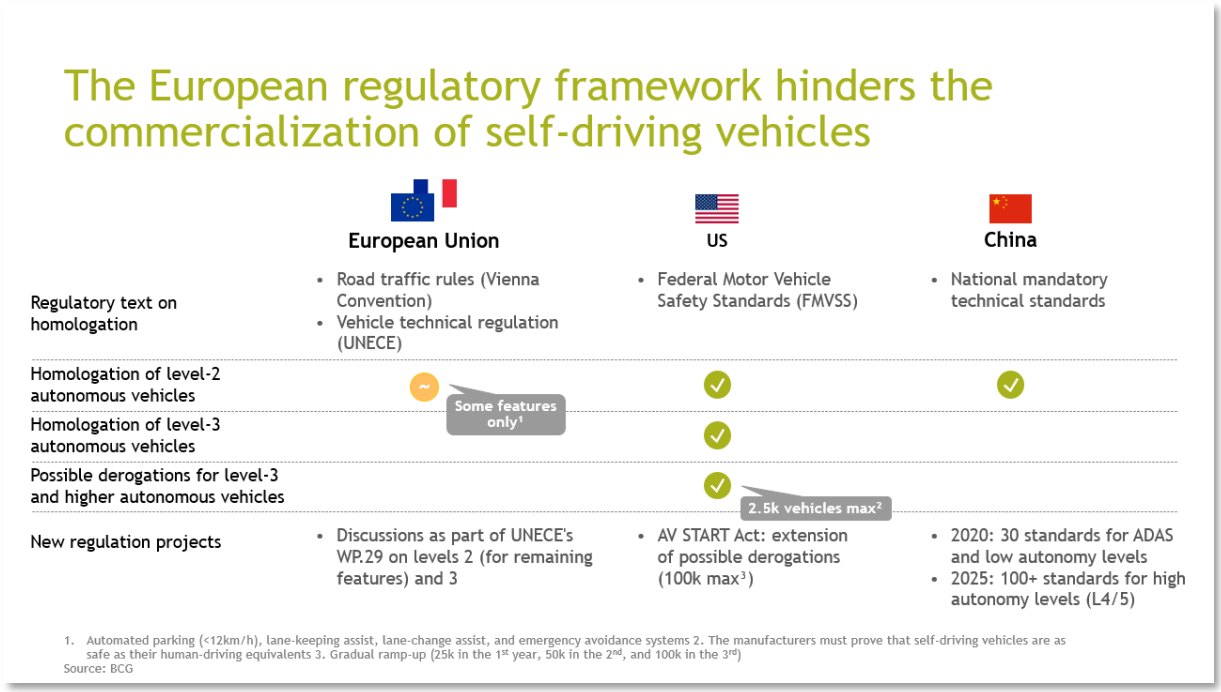
The regulation regarding the certification and homologation of self-driving vehicles in France and in Europe is constrained by the Vienna Convention on road traffic (adopted in 1969) and the European technical regulation on vehicles, established in Geneva under the aegis of the United Nations Economic Commission for Europe (UNECE).

In 2016, the Vienna Convention was amended to authorize automated driving systems provided they are compliant with UN regulations or provided they may be controlled or deactivated by the driver. Yet, in the UNECE technical regulation, the 79 rule **only authorizes the homologation of some level-2 autonomous functionalities**: automated parking (with speed below 12km/h), lane-keeping assistance, lane-changing assistance and collision avoidance systems.

France must respect these regulatory frameworks and cannot thus homologate some level-2 automated driving systems (nor level-3 ones) unlike the United States or China, while the first level-3 systems are already available (for instance Audi's Traffic Jam Pilot). Such a framework

harms the European industry since **it hampers the commercialization of innovations relating to vehicle and shuttle automation** (domain in which France has pioneer companies).

Works are underway within the WP.29[34] to update the technical regulation regarding remaining level-2 and level-3 automated driving systems, but the process is long. Furthermore, France's involvement is limited, hence limiting the influence it could have on the progress of the discussions and on the decisions made.



In order to accelerate the definition of a French regulatory framework regarding the certification and homologation of self-driving vehicles, the Mission recommends the following actions:

<u>Recommendation 31</u>: Increase from 2019 the administrative resources dedicated to the certification of self-driving vehicles and shuttles.

<u>Recommendation 32</u>: Be a leader to accelerate the discussions on certification of level-4 and level-5 self-driving vehicles within the WP.29.

In order to certify the three French shuttles before mid- 2020, a regulation on self-driving shuttles and on the corresponding validation trials could be established before end 2019.

Within the UNECE and EU institutions, it is important to make sure that the directives of the European Commission about **the use of article 20 (derogatory regime) are available by end 2019** to enable the commercialization of level-3 self-driving vehicles and that the international discussions about the **certification of level-2 and level-3 self-driving vehicles (definitive**

[34] WP29: World Forum for Harmonization of Vehicle Regulations (UNECE)

regime) accelerate to land by 2020, through a reinforcement of the resources involved within the WP.29.

Lastly, a strong collaboration between German and French certification bodies on the future regulatory framework on the certification and homologation of level-4 and level-5 self-driving vehicles could be considered. A common white paper on the topic could be written by French and German OEMs so that this work is consistent with industrial developments.

2.4.6. Create the conditions of social acceptance of the self-driving vehicle

The study on the self-driving vehicle published by *L'Observatoire Cetelem*[35] reveals that **French people are skeptical about connectivity and automation technologies**:

- Only 41% of French respondents say they are interested in using self-driving vehicles (by way of comparison, the average of the 15 countries studied[36] is of 55%);
- The self-driving and connected vehicle is first associated with a costly vehicle (86% of respondents);
- The use of self-driving vehicles raises concerns, notably regarding the loss of vehicle control and the risks of breakdown.

The study also shows that French people trust OEMs to design self-driving vehicles (more than anywhere else in the world).

In order to reinforce the acceptability of self-driving vehicles in France, the Mission recommends to reinforce the communication on autonomous vehicles, in particular:

Recommendation 33: Leverage the communication around the self-driving vehicles demonstrated in Japan during the 2020 Olympic Games in order to demystify autonomous driving in France.

By 2021-2022, information campaigns about the benefits of self-driving vehicles and risk control (depending on the technological progress) could be launched in collaboration with relevant players (in particular OEMs).

The Mission also insists on the fact that the messages circulated will have to be defined depending on the maturity of self-driving vehicles in 2020-21 (in particular in terms of technological progress, safety level, costs, etc.).

[35] « Driverless cars: prepared to hand over the wheel » (2016)
[36] Belgium, Germany, Spain, France, Italy, Poland, Portugal, United Kingdom, Japan, United States, Brazil, China, Mexico, Turkey, and South Africa

3. Encourage the development of mobility services and players in France

3.1. A revolution is underway in mobility and should be leveraged

The convergence of a need for almost instantaneous on-demand services, anytime and every day, affordable and adapted to everyone, with the technological offer enabled by applications, connectivity, cloud and digital platforms, has triggered **a renewal and acceleration of some mobility solutions** (car sharing, on-demand transportation, ride sharing, fast on-demand deliveries, two-wheel vehicle sharing). This shift already has a significant impact on mobility, at least in dense cities.

Yet **the arrival of self-driving vehicles might entail a much deeper transformation of the mobility of goods and people**, at least in some large cities at the beginning, leading to evolutions of the automotive landscape, transportation operators, and cities themselves.

It is in the interest of France and its players to leverage this transformation by supporting it rather than enduring it. Indeed, the associated challenges are many and critical for citizens:

- The public transportation offer is often insufficient in far suburbs, making car use mandatory, regardless of its costs;
- The growing distance between workplace and residence, as well as individualism, have led to autosolism and to the fact that cars, but also road infrastructures, are partially used: 1.1 person per car on average in France[37];
- City congestion is ever growing: according to the TomTom Traffic Index, the average congestion level (average additional riding time as compared to a complete absence of traffic jams) grew from 31 to 38% in Paris, 24 to 29% in Lyon, and 23 to 31% in Bordeaux between 2008 and 2016;
- Access to mobility, which is also an access to employment and services, remains difficult for some people, further increasing some inequalities;
- Local pollution due to automotive emissions led numerous large cities in Europe to take measures to prohibit the circulation of some old diesel cars in city centers.

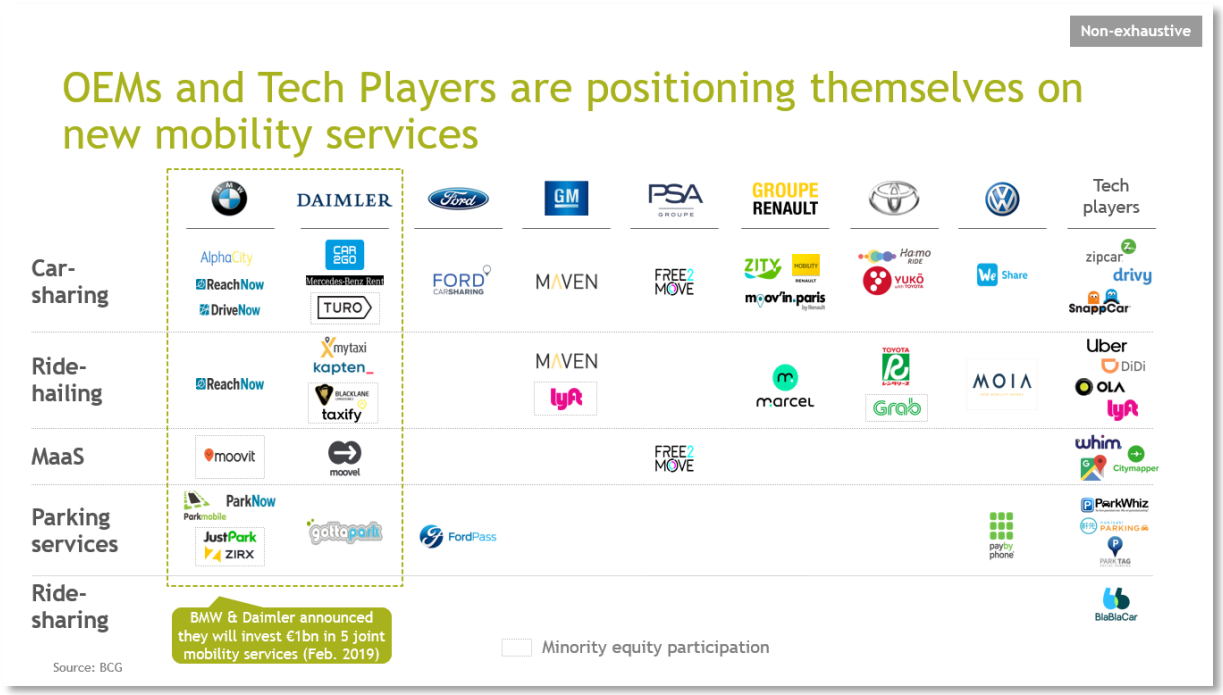
More generally,

- Greenhouse gas emissions due to vehicles significantly contribute to climate warming: in France, passenger cars represent 20.5% of CO_2 emissions, and 27.9% when including light commercial vehicles[38];
- The vehicle is a little-used asset (use rate around 5% in France[39], traffic jams and search for parking spaces included) yet represents a significant cost: 14% of household expenditures in France[40].

[37] Article in *Les Echos* « *La mobilité nouvelle religion de l'auto* », October 2018
[38] In 2016 (source: MTES Datalab, Key transport figures, 2018 edition)

In response to these stakes and thanks to the digital revolution, **new mobility services are developing, based on a shared car use**: car sharing (rental of a proximity vehicle for a short duration); ride sharing (joint use of a vehicle by its owner and several passengers for a common ride); ride hailing, etc. Moreover, new mobility service platforms (Mobility as a Service, or MaaS) aim at facilitating the user experience by covering the whole traveler journey (itineraries, payment, etc.) and by centralizing all available transportation modes.

The players that operate these new mobility services are **new entrants from the Tech industry, as well as more traditional automotive and transportation players** trying to position themselves in these new markets. As examples, Daimler created Car2Go in 2008 and BMW DriveNow (free-floating car sharing); Daimler also acquired different mobility operators among which Chauffeur Privé (Kapten today) in France for more than €1bn. Together, Daimler and BMW announced in March 2018 the creation of a 50-50 joint venture: "Your Now". Officially announced in February 2019, it combines their mobility services (ride-hailing, car-sharing, MaaS, parking and EV charging), with 1bn€ funding. Volkswagen, General Motors, Ford, and Toyota are following. PSA with Free2Move (in Europe, the United States, and China), and Renault with the acquisitions of Karhoo, Yuso, Marcel, and iCabbi are taking the same direction.



3.2. The public-private mobility ecosystem should be transformed

A mere market logic combined with private players' dynamism and investments will not be enough to succeed in this transformation.

[39] Source: Ademe
[40] Source: Insee

Indeed, the massive development of private cabs in the United States has had serious consequences on traffic and traffic jams. Thus, in New York, the near doubling of on-demand rides (taxis and private cabs), impelled by Uber and Lyft, has contributed to a decrease in the average speed in Manhattan at peak hours of 18% in 4 years[41]. In San Francisco, from 2010 to 2016, the hours lost in traffic jams have increased by 62% of which half is attributed to private cabs[42].

On-demand self-driving car services, less costly than current private cabs, would be more popular, more numerous, and would generate an inacceptable traffic for citizens. **A public regulation will thus have to be implemented by large local authorities**, leading to:

- More shared rides;
- Less individual cars (in terms of traffic and parking);
- Urban design (pick-up and drop-off points, parking lots, etc);
- Service contracts and a regulation for fleet operators (after calls for tenders);
- Safety commitments for self-driving vehicles, possibly supported by a connected infrastructure in some locations[43];
- A largely shared vision of the target objective;
- A transition plan with complex political decisions to be made, yet with great value for users.

This requires having **a clear and legitimate public decision-maker or a robust and durable consensus** on all these topics for each large city.

Before launching such operations, the public leadership, constituted by elected representatives of each large city and their respective public transportation authorities, will want to ensure that nothing lacks in the ecosystem to be put in place, to test the citizens' response to the new offer, then to simulate, plan, and support the transformation. The possibility to use the data produced by these new services to provide a smooth and simple multimodal experience (for instance MaaS), then to improve mobility policies (in their design phase thanks to simulations as well as in their implementation phase thanks to impact monitoring) will be probably required.

The list of prerequisites to be mastered to deploy such a transformed ecosystem is long:

- Self-driving technology (and a remote management platform);

[41] "*Empty seats, Full streets. Fixing Manhattan's Traffic Problem*", Schaller Consulting (December 2017), data from NYC Taxi & Limousine Commission

[42] San Francisco County Public Transport Authority

[43] Self-driving vehicle safety is not only linked to the vehicle itself but also to traffic conditions and various risks where it is used. Guarantees will have to be provided to local authorities in critical locations, possibly by relying on connected infrastructures

- What enables to implement it locally: detailed mapping of the operation area, « software in the loop » simulations on digitized selected roads, infrastructure equipment to ensure the required safety level;
- Vehicles adapted to shared rides (electric vehicles of different sizes);
- The platform to operate the on-demand (shared) transportation fleet, including:
    - E-Dispatch Management System,
    - Applications for customers and drivers (for the remaining ones);
    - CRM,
    - Payment;
- Tools to acquire precise mobility data;
- Tools to simulate mobility offer and demand, coupled with road traffic simulation software;
- Cleaning and charging sites for self-driving electric vehicles;
- Skills to enable the collaboration between public transportation authorities, large cities, and operators;
- Credentials or large-scale concrete tests to ensure social acceptability of these new mobility services.

In suburban or rural territories, car-pooling applications already enable to offer mobility solutions to those without cars, who cannot drive anymore or cannot bear the costs of daily individual rides. In the future, on-demand shared self-driving vehicles will enable the local authorities of these territories to broaden available mobility services.

France may be a leader in this transformation if it is able to initiate early enough the implementation of such ecosystems, engage in a transition path, and involve French and foreign companies that will have the opportunity to innovate, then capture part of the value created by these markets. France has numerous assets to rely on:

- Experience in public-private operations;
- Strong voluntarism from some large local authorities;
- World-class public transportation operators;
- Dense heavy public transportation infrastructure, basis for on-demand mobility in suburbs (enabling to « feed » train, suburban train or tramway stations);
- 2 major OEMs and several shuttle manufacturers;
- Outstanding capabilities in complex system simulation;
- Local mobility and simulation platforms;

- Ongoing operations of on-demand shared transportation services (Keolis in Bordeaux after Keolis-Via, Uber in Paris, Uber in Nice, etc);
- Concrete operations soon to be launched with the EVRA call for projects.

3.3. Proposed actions

3.3.1. Encourage the development of the new mobility service market

The size of the mobility service market is a significant factor of attractiveness to stimulate local players and attract foreign investments. Yet, except for ride-hailing, these new services remain relatively limited in France.

Ride-hailing (Uber, Kapten, etc) seems to develop fast; an appropriate regulation could encourage the electrification of this transportation mode. Since current batteries enable to run all day with limited recharging during breaks, private cabs could be strongly encouraged to use electric cars. As their driving is essentially urban with high mileage, this would reduce NOx and CO_2 emissions. One possible option would be to authorize electric private cabs to circulate on bus lanes and other priority lanes, like taxis.

Car-pooling: these services seems to develop fast, in particular in the Paris region. But above all, the project of Mobility law should:

- Create and implement a sustainable mobility package, which should enable employers to contribute to their employees' costs for home-work trips in car-pooling;
- Enable local authorities to subsidize car-pooling services to make them financially more attractive.

Car-sharing: France is rather lagging behind since Autolib service was stopped. The first reason mentioned by operators is the mayors' reluctance to accept a flat fee for parking spaces in dense areas. However, this has been done in Paris mid-2018 and has enabled Car2Go to launch its operations after Renault-ADA and PSA-Free2Move.

Car sharing is getting gradually closer to car rental, yet without the obligation for the customer to go to an agency, and for durations from 10-20 minutes up to one weekend with adapted pricing. This is thus a solution to decrease car stock, reduce the pressure on parking, and enable a better use of cars. They are massively electric in Europe[44]. This solution should be therefore encouraged in large cities. Car sharing between individuals remains marginal to date.

On-demand shared transportation: this mobility mode, whose business model is hardly profitable today, seems to be the most appropriate to prepare the arrival of on-demand shared self-driving vehicles (the first step needs to include drivers).

[44] 93% for Vulog

In this domain, Ford acquired then developed Chariot in several American cities but the company stopped it in January 2019. Volkswagen created MOIA in Germany and has deployed it with 6-seat vehicles with central corridor in Hannover (2017) then Hamburg (2018). Keolis has made tests with Daimler in Bordeaux. At least one significant experimentation on autonomous driving is planned by the Paris region.

Recommendation 34: Encourage, through financial and non-financial incentives, new shared mobility solutions, in order to extend the mobility market, aiming in priority at those that offer the most significant environmental and mobility benefits. For example:

- Sustainable mobility package and possibility for local authorities to subsidize car-pooling solutions, planned in the Mobility law project;

- Promotion of electric car-sharing to large cities (with fees for parking spaces).

3.3.2. Support the French companies with high potential in new mobility and mobility engineering services

While France has strong historical players in the transportation sector (RATP, Keolis, Transdev), it seems to be lagging behind today in the new mobility services, with few players of international size, except BlaBlaCar. However, France has numerous start-ups with high potential that have developed world-class technologies – this is for instance the case of Vulog (leader in independent car-sharing platforms).

Furthermore, a critical activity in tomorrow's mobility is the **simulation or mobility engineering**: collection and processing of mobility data, simulation with new mobility offers (agent-based modeling), and coupling with road traffic models. Beyond Urban Engine, acquired by Google in 2016, some classic players in traffic simulations are repositioning themselves in this field: the German PTV, acquired by Porsche (VW Group) or the Spanish Aimsun, acquired by Siemens. France has a strong simulation expertise with global players (Dassault Systèmes, ESI, etc) but not in this domain, as well as some start-ups.

The Mission considers that the knowledge and monitoring of these mobility companies, to support their development and federate a real mobility ecosystem in France, could be improved by clarifying the administrative organization in charge of performing these tasks and by providing financial support to stimulate their development.

To support the development of French companies with high potential in the new mobility market, it could be useful to:

- Structure the monitoring of the "mobility service and mobility engineering" sector within the DGE to ensure an effective follow-up of the sector and coordinate the actions of involved public bodies (ADEME, Bpifrance, French Tech, DGITM);

- Create and update a database of French companies and start-ups with high potential in new mobility;

- Support (exportation, subsidies, equity participations, loans, etc) the promising start-ups through Bpifrance.

3.3.3. Generate and support a few operational pilots of on-demand shared mobility, enabling the gradual intervention of self-driving vehicles and the implementation of the related ecosystem

The development of self-driving vehicles will be possible only if local authorities and metropolises develop to that end an appropriate regulatory or contractual framework. Several experimentations have already been launched, as part of EVRA call for projects. These experimentations, although numerous, are scattered on many territories, and the limited size of each experimentation will not enable to start building the ecosystem required for the implantation of shared self-driving vehicle fleets, nor to estimate the implementation conditions and the impact they might have on overall mobility management at the scale of a territory.

A limited number of operational pilots with sufficient scale, concentrating all the technological bricks required for the implementation of mobility solutions including self-driving vehicles, and relying on a close collaboration between local authorities, OEMs, mobility operators and other service providers, would enable to test a new ecosystem.

The objective would be to introduce **a shared transportation service able to gradually shift toward services operated by self-driving vehicles**. This might also concern the transportation of small goods. These projects would enable companies from automotive or transportation sector, or start-ups, to collaborate in the same territory, in a very practical way, and to develop know-how and technologies that are fundamental to position themselves in this emerging market.

Other services might be tested, and could mobilize French companies, for instance:

- Acquisition of precise mobility data;
- Simulations of mobility offer and demand, and of the consequences on traffic of robo-taxi fleet implementation;
- Mapping and precise positioning for self-driving vehicles;
- Real-time digital twin of infrastructure;
- Connected infrastructure equipment for self-driving vehicles in the most critical locations for autonomous driving;
- Pre-validation through simulation of self-driving vehicle software;
- Remote control centers for self-driving vehicles;
- Development of pick-up and drop-off points;
- Charging equipment and management;
- Maintenance and cleaning of shared vehicles;
- On-demand transportation management platforms such as MaaS;
- Management and sharing of mobility data under the aegis of local authorities.

Recommendation 35: Deploy by 2021 on-demand autonomous transport services, enabling the gradual introduction of self-driving vehicles and the implementation of the related ecosystem.

For each territory, the pilot should:

- Enable to operate self-driving vehicles, preferably shared, on well-defined journeys;

- Be jointly led by the relevant local authority and its public transportation authority, a mobility operator already present, and one or several OEMs working with different companies to constitute the required ecosystem for their operations.

To target an implementation between 2021 and 2022, a study phase of a few months should start promptly.

4. Capitalize on France's strengths to reinforce its attractiveness in the automotive industry and related industries

4.1. Context and stakes

For foreign automotive and battery manufacturers, it is critical to establish or expand their presence in Europe to gain access to the **European market**, which is **strategic due to its size and profitability potential.** The main attractiveness criteria according to the foreign players met as part of the Mission are: access to potential customers, access to skilled and competitive labor force, access to an ecosystem of suppliers and partners (notably, in the case of batteries, for a secure supply in raw materials) and a competitive cost position notably through the granting of public support for investments (subsidies, tax alleviation, etc).

Even though, over the past years, France has improved regarding the attractiveness of its whole economy[45], the country **should pursue its efforts to attract foreign investment projects in the automotive industry and related businesses** (batteries, semiconductors, etc). Thus, while several Asian battery manufacturers are deploying or planning to deploy industrial capacities in Europe (in particular in Eastern European countries), no such project has been announced in France to date.

Yet, France **has many assets to leverage**:

- Access to potential customers: presence of two major domestic car manufacturers (Renault and PSA), of Toyota and Daimler which operate assembly lines in France and of world-class mobility players (Transdev, Keolis, RATP);

- Access to potential suppliers and partners: presence of world-class automotive suppliers (Valeo, Faurecia, Plastic Omnium, Michelin) and raw material suppliers, in particular for batteries (Eramet, Arkema, Imerys);

- Access to skilled labor force: France has many valuable talent in manufacturing, notably engineers and technicians, as well as a productive manufacturing workforce;

[45] 1 019 foreign investment projects were announced in 2017, increasing by 31% versus 2016, according to the EY attractiveness survey (2018)

- France's geographic location, at the center of Europe, and the effectiveness of its national and international transport networks;

- Tax incentive mechanisms such as the R&D tax credit (*Crédit d'Impôt Recherche*[46]), which enables to reduce labor costs in engineering centers and make them competitive at European level;

- The new Labor law, which simplifies the social dialogue between employees and employers and makes it easier to adapt rules to the reality of each company. For instance, this law provides for the merger of employee representative bodies within a single body (the "Economic and Social Committee") or the primacy of company-level agreements over industry-wide agreements in most areas. The company is now the privileged place for collective bargaining.

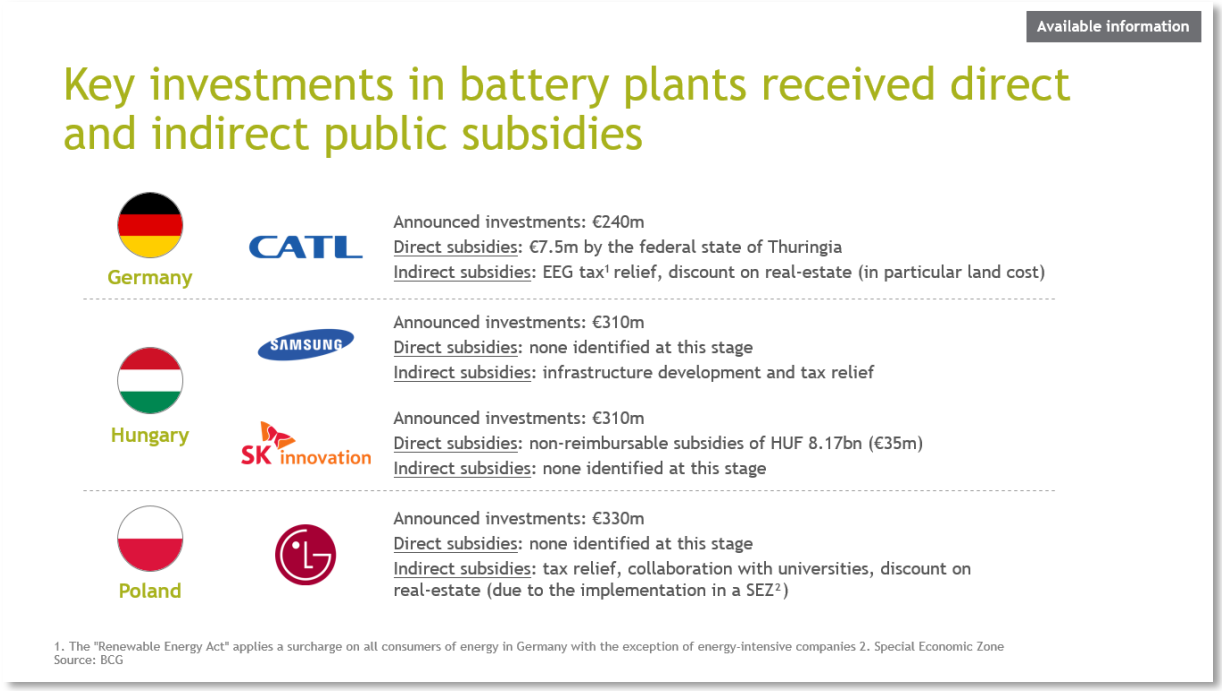
Several investment projects in Europe should be decided in the months or years to come, notably by Asian battery manufacturers (for cell manufacturing plants for instance) and OEMs (for technical and operational centers for instance). To attract them, it is highly important to promote France's assets, as well as to strengthen its attractiveness, while pursuing public authorities' efforts to enhance France's image towards foreign companies.

4.2. Proposed actions

4.2.1. Framework on State investment aids

Among the factors of attractiveness mentioned by the foreign players who wish to operate in Europe, **the level of granted subsidies is systematically mentioned.** For instance, all the battery manufacturers who recently announced the opening of cell manufacturing facilities in Europe have benefited from direct or indirect public subsidies from host countries.

[46] The tax credit rate amounts to 30% of R&D expenditure up to €100m, and 5% above



France being a member of the European Union, **the granting of public subsidies for the benefit of private players is ruled by the Community regulation**, which stipulates that:

- Granting State subsidies to large corporations for productive investments is not authorized as a rule;
- However, the regional aid compatibility framework provides an exception to that principle: for each Member State, are defined a list of eligible territories, a maximum aid rate[47] and a threshold beyond which the aid should be notified to the European Commission.

France is disadvantaged by this regulatory framework as, generally speaking, maximum aid rates are lower for the most developed countries (regional aid aims at favoring the industrialization or reindustrialization of disadvantaged territories in Europe). Thus, **the 10% rate set for large corporations in mainland France does not enable to offer subsidy levels as attractive as in some Eastern European countries (where the rate can reach 25% or more).** In a time of important changes, such as the emergence of a battery industry for electric vehicles, this might prevent France from competing in those new markets.

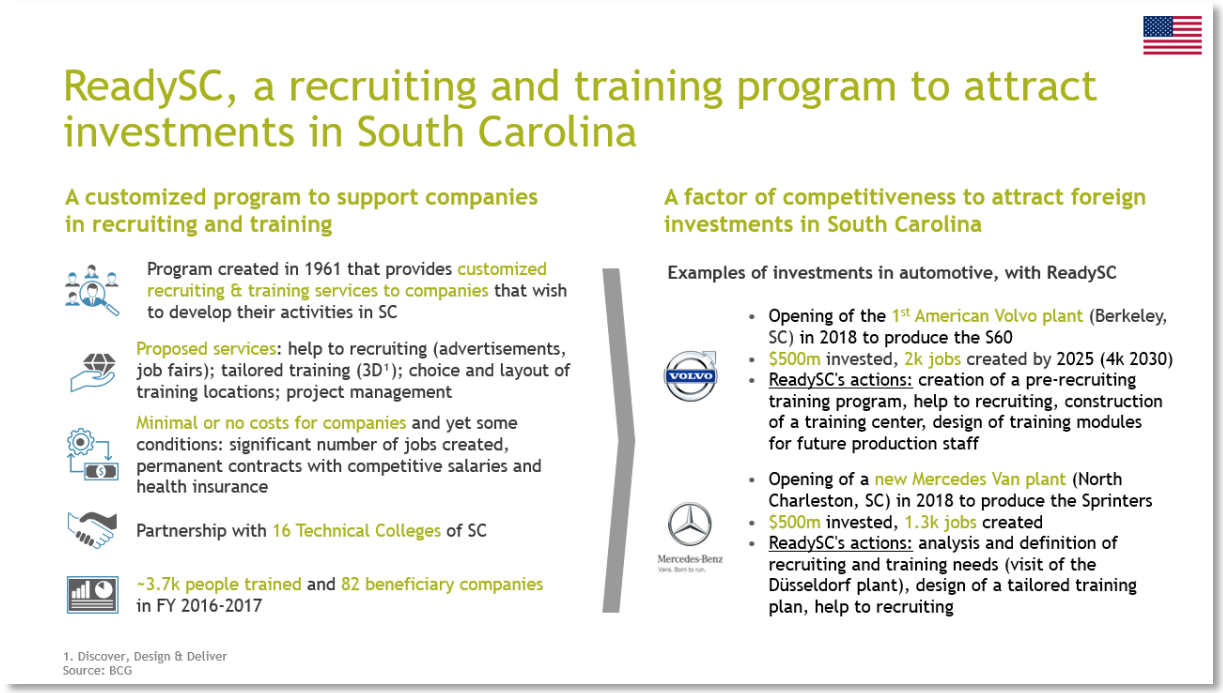
To be attractive as compared to other European countries, it is necessary to mobilize all the existing financing tools that comply with regulation for a given investment: equity participation or financing (Bpifrance, EIB, CDC); direct subsidies (subsidies ruled by the regional aid mechanism, training aid); other schemes (R&D tax credit, participation in infrastructure building).

[47] The maximum rate depends on the size of the recipient company and the amount of the State aid

In the longer term, France could advocate strongly in favor of **rebalancing maximum aid levels** (and notification thresholds) for productive investments between the various Member States of the EU, at the latest as part of the renegotiation of guidelines on State aids scheduled in 2022.

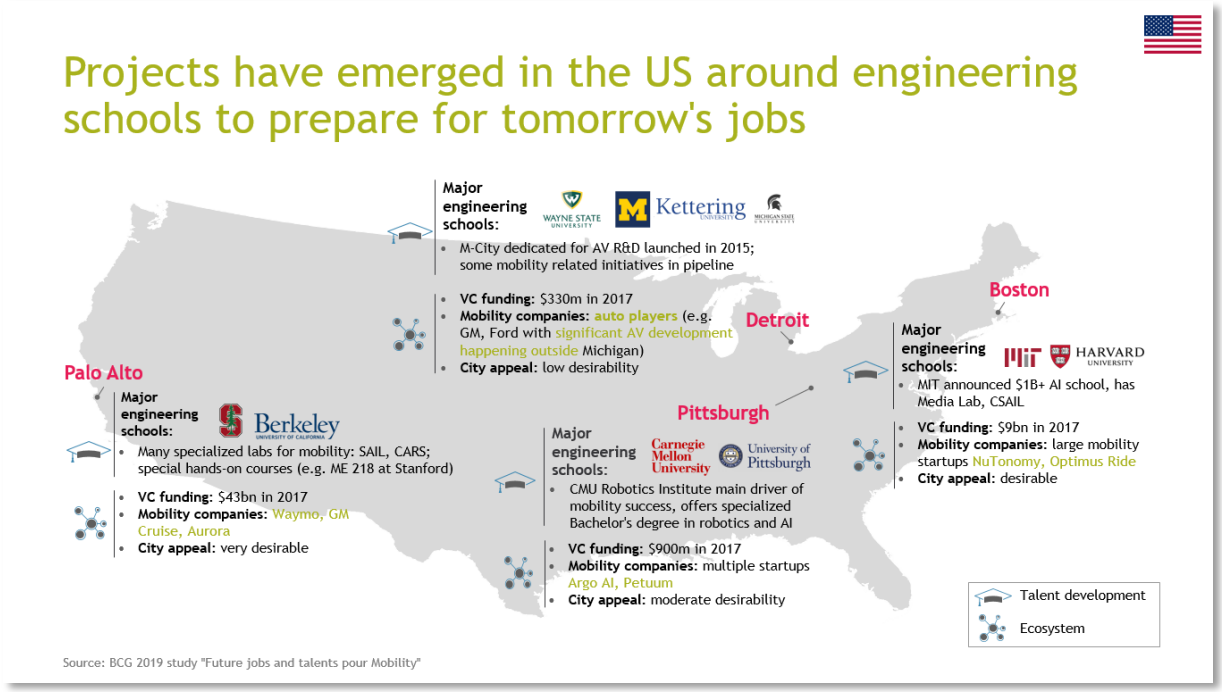
4.2.2. Invest in talent and skills

Access to talent and skills is a key factor of attractiveness in the automotive industry and mobility. Proposing tailor-made recruiting and training plans to the industrial players wishing to settle in Europe could therefore be a strong lever to attract them in France. The ReadySC scheme implemented in South Carolina (United States) to attract foreign investments by supporting companies in their recruiting and training efforts has already proven its worth and is a model France could draw from (see below).



Moreover, **talent and skill requirements** will evolve, since the automotive industry and production methods will experience major technological disruptions (electrification, connectivity, automation, robotization, AI and machine learning, etc). Anticipating those changes and integrating them into the training of engineers, technicians and operators will therefore be an additional factor of attractiveness; this stake is taken into account by the Strategic contract for the Automobile sector.

In line with this, public-private training initiatives are being implemented **in order to prepare the automotive industry for tomorrow's jobs**, in particular in the United States around world-class universities (see below) and in France around private players (Michelin with Hall 32, Safran in Commercy, etc).



Therefore, the Mission issues the following recommendation:

<u>Recommendation 36</u>: Create, as of 2019, a structure enabling industrial players that consider locating facilities in the national territory to have access to a **unique interlocutor for the recruiting and training of talent and skills in France** (information, first contact with training centers, support, etc). Such an organization would involve:

At the national level: Business France (which performs monitoring of investment projects and coordinates relationships with project owners), DGEFP and DGT (which are responsible for vocational training and labor policies);

At local level: local authorities, *Pôle Emploi* and the Direccte[48].

Other actions could be taken to develop talent and skills, in particular at the local level. An approach could be to:

- Clarify the training requirements associated with tomorrow's automotive and mobility industry: working with PFA in order to define talent and skill requirements, formulating associated training requirements with the UIMM and the French National Education, and cascading them into existing and ad-hoc training structures;

- Support the local training initiatives that gather training establishments and industrial players in order to prepare for future automotive jobs (such as the Hall 32 project for instance): access to teaching staff and co-funding as needed;

[48] *Directions régionales des entreprises, de la concurrence, de la consommation, du travail et de l'emploi* (French Regional Directorates for companies, competition, consumption, work, and employment)

- Prepare a deployment playbook for this type of public-private training initiatives (the French « Territories of Industry »[49] could be privileged locations).

4.2.3. Monitor and support known investment projects in the automotive, mobility, battery or semiconductor industries

Many investment projects in the automotive, battery and semiconductor industries are to be foreseen in the short and mid-term, given the evolution of the European market toward electromobility. To attract those investments, France should position itself as an attractive country, notably through Business France.

To that end, it is necessary to enhance the proactive monitoring of investment projects planned by foreign players in Europe and France in the automotive, mobility, battery or semiconductor industries and regularly update the list.

It is also important to support the investment projects identified by the Mission (notably in China) as well as the other known or upcoming projects to ensure that France can be part of considered location options, and to do so:

- Strengthen the communication on France's attractiveness for those players;
- Provide them with a competitive offer (financial and tax incentives, talent and skills, supply chain security, energy cost, etc.)

4.2.4. Encourage reciprocity in trade relations with foreign countries

China has become a key automotive player. Thanks to a large domestic market and strong incentives, **Chinese players are among the leading global battery and electric vehicle manufacturers:**

- In the first half of 2018, in China, the Top 11 OEMs[50] in the electric passenger car market were Chinese and accounted for ~87% of the market;
- Today, Chinese battery manufacturers such as BYD and CATL are global leaders, with a strong will to develop abroad.

This spectacular growth is based **on a strong interventionism and protectionism from the Chinese government**, including notably:

- Subsidies granted to Chinese battery manufacturers (e.g. $590m in subsidies and loans were granted to BYD between 2013 and 2017);
- Almost impossible homologations for electric vehicles equipped with batteries produced outside China or by non-Chinese players;

[49] "*Territoires d'industrie*"
[50] BYD, BAIC, SAIC, Geely, Chery, JAC, JMC, Hawtai, Zotye, Changan, GAC (source: France Stratégie *"L'avenir de la voiture électrique se joue-t-il en Chine?"*)

- Public incentives for the purchase of electric vehicles granted only for those that are equipped with Chinese batteries.

In this context, according to us, enhancing reciprocity, notably vis-à-vis China, in market access conditions for key industries seems necessary.

Regarding batteries for electric vehicles, two possible actions could be considered:

- Take into account the CO_2 footprint of batteries (lower in France thanks to the low-carbon energy mix) in the evolutions of the environmental bonus granted to electric vehicles;

- Make sure future European batteries can be sold in China: this access to the Chinese market will enable European OEMs to integrate European battery technologies into their global vehicle platforms and, therefore, reinforce the attractiveness of these European technologies.

Annex 1: Assignment letters

Engagement letter to Mr Mosquet and Mr Pelata

Dear Sirs,

The automobile industry is one of the driving forces in our country, with strong manufacturers and leading suppliers However, it is clear that our industry is suffering a degree of erosion, and that the degradation of our trade balance in this sector has accelerated.

There are, however, many opportunities, with ongoing revolutions in the fields of clean mobility and driverless and shared vehicles. The ecological and digital transitions are shaking up the sector, while the lines between actors are becoming increasingly blurred.

We need to seize the opportunity of these revolutions to best position France and its automobile industry. We can only do that by forging close ties between industry and the public authorities, in order to make France one of the most attractive territories in Europe and worldwide to develop and implement tomorrow's mobility solutions.

A first step was taken with the strategic contract for the automobile sector that was signed on 22 May 2018. This contract can, however, still be further deepened in several areas. What are the fields of the future (R&D, technologies, services, industrial activities) in which France can stand out globally? How can France be better positioned in these fields to compete at international level, particularly with a view to attracting internationally mobile investments? How can we best take advantage of the ongoing revolutions around clean vehicles, intelligent (self-driving and connected vehicles) and new mobility services?

Answering these questions is the key aim of the mission I wish to entrust to you. To achieve this, I am asking you to produce an analysis of France's, and Europe, current positioning in the automobile sector and the field of new mobility solutions by the end of November. To do so, you should make contact with the key decision-makers in these fields, in France and abroad, and draw on the best global practices. You should then, by January 2019, draw up recommendations in terms of guidance, initiative and public policies for both the government and the industry, in liaison with the relevant government departments. This work should seek to put forward tangible, specific actions for implementation in partnership between the public authorities and private actors. It should include an analysis and proposals as to the fields of strategic cooperation with our partners that should be strengthened, particularly and in Europe and with Germany.

In order to fulfil your mission, you should work closely with the staff of the Ministry of the Economy and Finance, which will provide you with a rapporteur responsible for supporting your work and with the automobile industry strategic committee. As necessary, you can call upon the support of staff from the Ministry for the Ecological and Inclusive Transition, the Ministry for Higher Education, Research and Innovation, and, more generally, any administration useful to draft your recommendations.

You will report back regularly to the representatives of my office and those of the relevant ministers.

Yours sincerely,

Liberté • Égalité • Fraternité
RÉPUBLIQUE FRANÇAISE

Le Premier Ministre

Paris, le 29 OCT. 2018

1741/18 SG

Monsieur,

L'industrie automobile est l'une des premières forces de notre pays, avec des constructeurs puissants et des équipementiers de premier rang. Pourtant, force est de constater que notre industrie souffre d'une certaine érosion, avec notamment une dégradation accélérée de notre solde commercial dans ce secteur.

Les opportunités sont pourtant nombreuses, avec les révolutions en cours de la mobilité propre et des véhicules autonomes et partagés. Les transitions écologique et numérique bouleversent le secteur, dans un contexte où les frontières entre acteurs s'estompent de plus en plus.

Nous devons tirer parti de ces révolutions pour positionner la France et son industrie automobile au meilleur niveau. Nous n'y parviendrons qu'en tissant des liens étroits entre l'industrie et les pouvoirs publics, afin de faire de notre territoire l'un des plus attractifs aux niveaux européen et mondial pour le développement et l'industrialisation des solutions de mobilités de demain.

Une première étape a été franchie dans le cadre du contrat stratégique de filière automobile du Conseil national de l'Industrie (CNI) signé le 22 mai 2018. Ce contrat peut néanmoins être encore approfondi autour de plusieurs questions. Quels sont les domaines d'avenir (R&D, technologies, services, activités industrielles) dans lesquels la France peut tirer son épingle du jeu au niveau mondial ? Comment, dans ces domaines, mieux positionner la France dans la compétition internationale, notamment en vue d'y attirer des investissements internationalement mobiles ? Comment tirer au mieux parti des révolutions en cours sur les véhicules propres, les véhicules intelligents (autonomes et connectés) et les nouveaux services de mobilités ?

Ces questions constituent le principal objet de la mission que je souhaite vous confier. Dans ce cadre, vous formulerez, d'ici la fin novembre, un diagnostic du positionnement de la France dans le secteur de l'automobile et des nouvelles solutions de mobilité. Vous mobiliserez à cet effet des contacts avec les principaux décideurs de ces activités, français et étrangers, et vous inspirerez des meilleures pratiques mondiales. Vous établirez ensuite d'ici fin janvier 2019, en coopération avec les services concernés de l'Etat, des recommandations en termes d'orientations, d'initiatives et de politiques publiques s'adressant à l'Etat mais aussi à la filière. Ce travail s'attachera à proposer des actions concrètes et précises qui associeront pouvoirs publics et acteurs privés pour leur mise en œuvre. Il comportera notamment une analyse et des propositions quant aux champs de coopération stratégiques à renforcer avec nos partenaires, notamment européens et en particulier l'Allemagne.

M. Xavier MOSQUET

Dans le cadre de votre mission, vous travaillerez en lien étroit avec les services du ministère de l'économie et des finances, qui mettra à votre disposition un rapporteur chargé de vous appuyer dans vos travaux, ainsi qu'avec le comité stratégique de filière automobile du CNI. Vous pourrez, en tant que de besoin, faire appel aux services du ministère de la transition écologique et solidaire, du ministère de l'enseignement supérieur, de la recherche et de l'innovation et plus généralement de toutes les administrations utiles à l'élaboration de vos recommandations.

Ces travaux feront l'objet de points d'étape réguliers avec les représentants de mon cabinet et des cabinets ministériels concernés.

Je vous prie de croire, Messieurs, à l'assurance de mes sentiments les meilleurs.

Edouard PHILIPPE

Liberté • Égalité • Fraternité
RÉPUBLIQUE FRANÇAISE

Le Premier Ministre

Paris, le 29 OCT. 2018

1740/18 SG

Monsieur,

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M. Patrick PELATA

Dans le cadre de votre mission, vous travaillerez en lien étroit avec les services du ministère de l'économie et des finances, qui mettra à votre disposition un rapporteur chargé de vous appuyer dans vos travaux, ainsi qu'avec le comité stratégique de filière automobile du CNI. Vous pourrez, en tant que de besoin, faire appel aux services du ministère de la transition écologique et solidaire, du ministère de l'enseignement supérieur, de la recherche et de l'innovation et plus généralement de toutes les administrations utiles à l'élaboration de vos recommandations.

Ces travaux feront l'objet de points d'étape réguliers avec les représentants de mon cabinet et des cabinets ministériels concernés.

Je vous prie de croire, Messieurs, à l'assurance de mes sentiments les meilleurs.

Edouard PHILIPPE

Annex 2: List of people interviewed

French National Assembly

- M. Cédric VILLANI, Member of Parliament

French Administration, State operators & local authorities

Presidency of the Republic

- M. Alexis ZAJDENWEBER, Advisor economy, finance, industry
- M. Cédric O, Advisor state holdings and digital economy
- M. Emmanuel MIQUEL, Advisor business, attractiveness and export
- M. Antoine PELLION, Advisor energy, environment, transport

Services of the Prime Minister

- M. Antoine SANTOYANT, Advisor economy, finance, industry
- M. Jonathan NUSSBAUMER, Advisor industry

General Secretariat for Investment

- M. Jean-Luc MOULLET, Director of the Industry Program

Interministerial Directorate of Digital and State Information System

- M. Bertrand PAILHES, National Coordinator of Artificial Intelligence Strategy

General Secretariat for European Affairs

- M. Loïc AGNES, Head of Industry, Telecommunications, Digital, Energy, Environment, Climate, Competitiveness
- M. Julien ROSSI, Head of Internal Market, Consumer Affairs, Competition, State Aid

Ministry of Ecological and Inclusive Transition

- Mme Elisabeth BORNE, Minister for Transport
- Mme Anne-Marie IDRAC, Responsible for the autonomous vehicle development strategy
- M. Xavier PLOQUIN, Advisor Energy, Industry & innovation
- M. Nicolas D'ARCO, Advisor responsible for new mobility and maritime transport to the Minister of Transport

Department of Climate and Energy

- M. Laurent MICHEL, General Manager
- M. Olivier DAVID, Head of Climate and Energy Efficiency Service
- M. Cédric BOZONNAT, Head of Private Cars Office
- M. Pierre BAZZUCCHI, Deputy Head Private Cars Office

General Directorate of Infrastructures, Transport and the Sea

- M. François POUPART, General Manager
- M. Xavier DELACHE, Deputy Head of Studies and Foresigh
- M. Guillaume PASSARD, Head of the Technical Policy Office

Ministry of Economic and Financial Affairs

- M. Aloïs KIRCHNER, Chief of Staff to the Secretary of State to the Minister of Economy and Finance
- M. Sébastien GUEREMY, Advisor industry and innovation
- M. Francis VUIBERT, Interdepartmental Coordinator for Electric Mobility

Directorate General for Enterprise

- M. Thomas COURBE, General Manager
- M. Franck TARRIER, Deputy Head of Transport Equipment, Mechanics and Energy
- M. Didier LE MOINE, Head of the Automotive Industry Office
- M. Masafumi TANAKA, Head of Electronic Systems Office

General Directorate of the Treasury

- M. Arnaud BUISSE, Head of Public Policy Department
- Mme Muriel LACOUE-LABARTHE, Deputy Head for Trade Policy, Investment and fight against Financial Crime
- M. Pierre CHABROL, Head of Trade Policy, Strategy and Coordination Office
- M. Thibault GUYON, Deputy Head, Sectoral Policies
- M. Adrien PERRET, Head of Industry Office, Knowledge Economy and Innovation
- M. Pierre MARTIN, Industry and Digital Advisor, Beijing Regional Economic Service

French Tech

- M. Nicolas AMAR, Managing Director

Ministry of Labour

General Delegation for Employment and Vocational Training

- M. Hervé LEOST, Deputy Head of economic change and job security
- Mme Kathleen AGBO, Project Manager anticipation and employment development

Ministry of Europe and Foreign Affairs

General Consulate in Guangzhou

- M. Pierre MAILLARD

Business France

- Mme Caroline LEBOUCHER, Deputy Chief Executive Officer
- Mme Ophélie LEFEBVRE, Strategic Projects Coordinator

Bpifrance

- M. Nicolas DUFOURCQ, General Manager
- M. Paul-François FOURNIER, Executive Director, Innovation Branch
- Mme Véronique JACQ, Director of the digital investment division
- M. Xavier DELEPLACE, Deputy Director of the Digital Investment Division
- M. Laurent ARTHAUD, Director of the life sciences investment division, environmental technologies and French tech acceleration
- M. Gilles SCHANG, Deputy Director of the life sciences investment division, environmental technologies and French tech acceleration

Agency for the Environment and Energy Management (ADEME)

- Mme Sophie GARRIGOU, In charge of the vehicles and transport of the future program
- M. Anthony LELARGE, Sustainable cities and new mobility program manager
- M. Maxime PASQUIER, Deputy Head of Transport and Mobility

Paris City Hall

- M. Emmanuel GREGOIRE, First Deputy Mayor - Budget, Public Policy Transformation and Relations with the Boroughs

Ile-de-France Area

- M. Christophe SAINTILLAN, Deputy General Director
- M. Laurent CALVALIDO, Advisor transports
- M. Patrick SPILLIAERT, Deputy Director of the Office of the President

Advisory and representative bodies

Manufacturer/supplier platform (PFA)

- M. Luc CHATEL, President
- M. Marc MORTUREUX, General Manager
- M. Jean-Luc BROSSARD, R&D Direcor

- M. Bernard LARGY, Battery Expert

Society of Automobile Engineers

- M. Jacques GRAIZON, President
- M. Hervé GROS, General Manager

National Council of Industry

- M. Philippe VARIN, Vice-President

French Association of Natural Gas Vehicles

- M. Jean-Claude GIROT, President

French Gas Association

- M. Patrick CORBIN, President

Private companies

OEMs

PSA Group

- M. Carlos TAVARES, CEO
- M. Grégoire OLIVIER, General secretary
- M. Laurent FABRE, Delegate public institutions France
- M. Mark ROLLINGER, Group Legal Director
- M. Nicolas LECLERE, Alternative traction and energy optimization manager

Renault Group

- M. Thierry BOLLORE, Managing Director
- Mme Mouna SEPEHRI, General secretary
- M. Gaspar GASCON ABELLAN, Executive VP Engineering
- M. Hadi ZABLIT, Senior VP Business Development
- M. Jean-Philippe HERMINE, VP Strategic Environmental Planning
- Mme Virginie GUERIN, VP Public Affairs
- M. Gilles NORMAND, Director of the Electric Vehicle Division

Renault Trucks

- M. Bruno BLIN, Executive Vice President Volvo Group and President Renault Trucks
- M. Philippe DIVRY, Senior VP, Group Trucks Strategy

- M. Jean-Marc LANGE, Director of Public Affairs

BMW Group

- Dr. Nicolas PETER, Chief Financial Officer of BMW AG
- Dr. Petrick KAI, Head of Open Innovation BMW Group
- Dr. Thomas BECKER, VP government and external affairs BMW AG
- M. Vincent SALIMON, Chairman of the Executive Board BMW France
- Mme Nathalie BAUTERS, Director of Communications and Public Affairs BMW France
- M. Elmar FRICKENSTEIN, Senior Vice President for Fully Automated Driving and Driver Assistance
- Dr. Maik BOERES, Head of the Future Mobility Team

BYD

- M. Leevon TIAN, Managing Director France
- Yang ROCKY, Marketing Auto

Daimler

- Dr. Dieter ZETSCHE, CEO
- M. Ola KÄLLENIUS, Responsible for Group Research & Mercedes-Benz Cars Development
- Dr. Michael HAFNER, R&D Director Autonomous Drive

Fiat Chrysler automobiles (FCA)

- M. John ELKANN, Chairman

GAC Motors

- M. Hanjun CHEN, Deputy General Manager
- M. Zhang ANWEI, Department Co-Director Component
- M. Ke ZENG, Deputy Director International Business Development

Jaguar LandRover

- Dr. Ralf DIETER Speth, CEO

Volkswagen AG

- M. Michael JOST, Head of Group Strategy Product and CSO Volkswagen Brand

Tesla

- M. Jérôme GUILLEN, President of Automotive

Toyota

- M. Didier LEROY, President, Business Planning & Operation, Chief Competitive Officer and Chairman, Toyota Motor Europe NV/SA

Suppliers

Bosch

- M. Heiko CARRIE, President Bosch France & Benelux

Faurecia

- M. Patrick KOLLER, CEO
- M. AUSSEDAT, Innovation Director
- M. Grégoire FERRE, Chief Digital Officer

Michelin

- M. Florent MENEGAUX, General Managing Partner - Member of the Group Executive Committee
- M. Thierry MARTIN-LASSAGNE, Director of Public Affairs France

Plastic Omnium

- M. Laurent BURELLE, CEO
- M. Philippe CONVAIN, Digital Manufacturing Director

SOITEC

- M. Paul BOUDRE, CEO

ST MicroElectronics

- M. Jean-Marc CHERY, CEO

Valeo

- M. Jacques ASCHENBROICH, CEO
- M. Geoffrey BOUQUOT, Head of strategy

Mobility players

BlablaCar

- M. Nicolas BRUSSON, CEO

Didi

- M. Eric Liang, Head of Government Affairs

Keolis

- M. Jean-Pierre FARANDOU, CEO

Nuance

- M. Charles KUAI, President Greater China Region
- M. Laurent KOCHER, Executive Director, Marketing, Innovation and Services

RATP

- Mme Catherine GUILLOUARD, CEO
- Mme Marie-Claude DUPUIS, Director of Strategy, Innovation and Development
- M. Mathieu DUNANT, Director of Innovation

Transdev

- M. Thierry MALLET, CEO
- M. Yann LERICHE, CEO North America & Head of Autonomous Transportation Systems

Uber

- M. Thibault SIMPHAL, Head of Western Europe
- M. Benjamin MARTIN, Public Policy & Government Affairs Manager
- Mme Miriam CHAUM, Head of Public Policy, Self-Driving Cars
- Mme Alexandra LAFERRIÈRE, Director Public Policy & Government Relations
- M. Andrew BECK, Business Development & Strategic Initiatives

Vinci Autoroutes

- M. Paul MAAREK, President ESCOTA network
- M. Blaise RAPIOR, General Manager ESCOTA network
- M. Baptiste ESCOFFIER, Head of Department

Vulog

- M. Gregory DUCONGÉ, General Manager

Waymo

- M. Tekedra MAWAKANA, VP Policy Development
- M. George IVANOV, Manager, Policy Development and Regulatory Affairs

Other private companies

Aimsun

- Mme Aurore REMY, Deputy Head

Air Liquide

- M. François DARCHIS, Senior Vice President
- M. Pierre-Etienne FRANC, Vice President, Hydrogen Energy World Business Unit
- Mme Aliette QUINT, Director Public Affairs, Hydrogen Energy World Business Unit

Arkema

- M. COLLETTE, Head of R&D

*AV Simulation (*OKTAL, SOGECLAIR)

- M. Emmanuel CHEVRIER, Managing Director
- M. Andras KEMENY, Expert

CATL

- Neill Yang, Marketing Director
- Xiangfeng Meng, Director of Public Affairs

Dassault Systèmes

- M. Sébastien MASSART, Head of strategy
- Mme Anne ASENSIO, VP Design Experience

EasyMile

- M. Gilbert GAGNAIRE, CEO

Enedis

- M. Dominique LAGARDE, Director of the Electric Mobility Program

Eramet

- M. Pierre-Alain GAUTIER, Head of corporate strategy

ESI

- M. Alain de ROUVRAY, President & Founder
- M. Vincent CHAILLOU, President & Managing Director
- M. Éric DAUBOURG, Managing Director
- M. Serge LAVERDURE, Virtual Systems & Controls Autonomous Driving Solution Director

Farasis

- M. Tony CHEN, Chief Financial Officer

F4.Maps

- M. Alexis GALLEY, CEO

Imerys

- M. Cyril GIRAUD, Vice President Performance Minerals APAC

Navya

- M. Christophe SAPET, Chairman of the Board

Springer

- M. Martin VARSAVSKY, CEO
- Mme Yasmine FAGE, COO

RTE

- M. Thomas VEYRENC, Markets and Regulatory Director

Total

- M. Patrick POUYANNE, CEO
- M. Julien POUGET, Senior Vice President Renewables

SAFRAN

- M. Stéphane CUEILLE, Head of R&T and Innovation

Saft

- M. Ghislain LESCUYER, CEO

Zeplug

- M. Nicolas BLANCHET, General Manager
- M. Frédéric RENAUDEAU, President & Founder

Research institutes

ATEC ITS France

- M. Jean COLDEFY, Mobility 3.0 Program Director

CEA

- M. François JACQ, General Administrator
- M. Jean-Pierre BENQUÉ, Scientific Advisor to the General administrator
- Mme Florence LAMBERT, CEA Liten General Manager

- M. Philippe WATTEAU, General Manager

CIRIMAT, Paul Sabatier University, Toulouse

- M. Patrick SIMON, Professor, specialist in battery chemistry

IFPEN

- M. François KALAYDJIAN, Director of economy and watch
- M. Guy MAISONNIER, Economy and Watch Department, Economics Department

The French institute of science and technology for transport, development and networks (IFSTTAR)

- M. Bernard JACOB, Managing Director, Science
- M. Antoine FREMONT, Deputy Head, Science
- M. Frédéric BOURQUIN, Director of the Components and Systems Department
- Mme Hélène TATTEGRAIN, Director of the laboratory TS2/LESCOT
- Mme Véronique CEREZO, Director of the laboratory AME/EASE
- M. François COMBES, Director of the laboratory AME/SPLOTT

INRIA

- M. Bruno SPORTISSE, CEO
- M. François CUNY, General Manager Innovation and Business Relations
- M. Jean-Frédéric GERBEAU, Deputy Director General for Science
- M. Fawzi NASHASHIBI, Team leader RITS

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