Syndex
> Automobile

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SUMMARY

EDITO

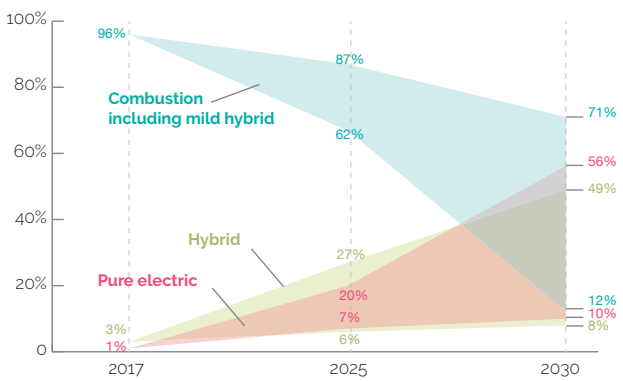
Will the automobile industry keep its key competitive advantage?

Between the decline of diesel and the emergence of electric motors, the automobile industry could lose one of its key competitive advantages: its expertise in drive trains. But there's still everything to play for and the next few years will be decisive.

The decline of diesel to the benefit of petrol and the gradual emergence of electric vehicles mean that these traditional players must reposition and it is also opening the way for new players to enter the market.

Even if sales of electric vehicles currently remain marginal, there is no doubt that electric motors (either 100% electric, or hybrids to varying degrees) will be an inescapable part of the future. And electrification means disruption of the whole drive train value chain.

WHICH TECHNOLOGY WILL DOMINATE THE MARKET FOR ENGINES IN 2030?
(Minimum and maximum share of different technologies in production forecasts as a %)



The estimates for 2030 reveal the uncertainty of the forecasts (by IHS Markit, ECF, Roland Berger, Ricardo, Fraunhofer, PWC-Autofacts, LMC), but confirm the growth of hybrid and 100% electric technologies.

Interpretation of the graph: in 2030, the most conservative forecasts still say 71% combustion engines, as opposed to 12% for those predicting a rapid migration to electric and hybrid.

It should be noted that mild hybrid, included here in combustion, is predicted to represent between 20 and 40% of motors by 2030

Diesel: the decline is gathering momentum and is expected to continue

In Europe, the main region for the production and use of diesel vehicles, the downward trend began in 2012, but seriously accelerated in 2017. Explanations.

Changes to emissions standards for pollutants, particularly the introduction of the Euro 6 Standard at end 2014, which requires a substantial reduction in emissions of nitrogen oxide (NOx) by diesel engines, have made manufacturers all but eliminate them from small city cars. The cost of diesel engines was no longer compatible with the selling prices of these categories of vehicles. So, in France and Spain, where diesel was particularly prevalent1 and where mid- and low-range small vehicles are very popular, the decline of diesel began well before the scandal of the rigged tests at Volkswagen at end 2015. In Germany and the United Kingdom, where sales of top-of-the-range vehicles are almost twice as high2 as in France, the peak of diesel sales has been far more recent and the drop only became truly apparent during 2017.

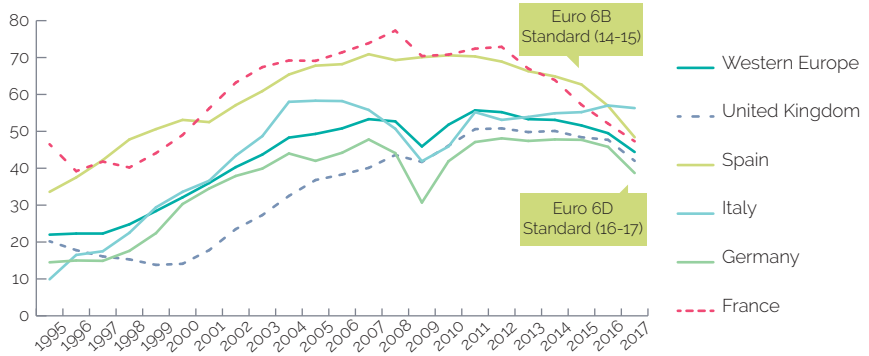
In the European market, petrol vehicles are now the most widely sold. Direct fuel injection (GDI) technology is the big winner in this new trend: inspired by common rail – which made diesel successful - GDI considerably reduces emissions of CO2… but at the expense of higher emissions of particles. From this point of view, diesel engines fitted with a particle filter would be the best bet.

CHANGING BEHAVIOUR? In view of the Climate-Energy transition plans of governments and the bigger European cities3, buyers seem to be changing their behaviour: many are moving away from diesel vehicles that they believe they might no longer be able to drive everywhere or sell second hand (but they are also buying more SUVs and crossovers!). This trend is encouraging manufacturers to further reduce their ranges. Toyota, and more recently Nissan, have thus announced their intention of no longer selling light diesel vehicles in Europe. The European manufacturers are revising their engine production forecasts downwards from 2025. Engine makers are not working on any new platforms and most of them are putting their engineers to work on petrol instead.

STRATEGIES. The hardest hit players are developing strategies to limit the decline in diesel. The Bosch Group has developed a system to drastically reduce NOx emissions, thanks to which it will easily be able to reach the emissions objectives of the future Euro 7 Standard. At the same time, the manufacturers are all busy working on mild hybrid projects, which could prolong the life expectancy of combustion engines. Lastly, the new regulations introduced in some big cities (e.g. Hamburg) ban polluting diesel engines predating the Euro 5 Standard, but allow "clean diesels".

Whereas the decline of diesel is inevitable, it might not necessarily disappear altogether. Its future will depend, on the one hand, on the environmental, economic and driving performance of hybrid technologies and, on the other, on the speed of development of rechargeable electric solutions.

CHANGES TO REGISTRATIONS OF DIESEL VEHICLES
(as a % of sales of light vehicles, source: AAA)



1. 80% in France and 73% in Spain in 2016 according to figures published by the French Automobile Manufacturers Committee (CCFA).
2. 37% in Germany, 35% in the United Kingdom, 27% in Spain, 20% in France according to figures published by the CCFA.
3. The city of Paris has set itself the goal of banning diesel engines in 2024 and petrol engines in 2030. On the national scale, the Hulot Plan announced in July 2017 calls for the end of combustion engines in 2040. However, these plans do not specify is this also concerns hybrid vehicles

Electrification: several development routes are possible

For ecological and health reasons, it's a certainty that the electrification of vehicles will continue. What is less certain is the speed and intensity of this transition, as well as the technological choices that go with it.

Concerned about improving air quality, governments are changing emissions standards. In Europe, the Commission is considering reducing the upper limits for emissions set for 2021 by 30% for 2030, and imposing sanctions if the objectives are not met. The Euro Standards also provide an increasingly strict framework for the atmospheric pollutants that result from the combustion of fuel and cause health problems, including particles and nitrogen oxide (NOx). Meanwhile, China has decided to put in place ambitious quotas for electric vehicles, thus encouraging manufacturers to invest in this technology.

The optimisation of combustion engines and the addition of post-processing systems (particle filters, NOx traps, etc.) will not in themselves achieve the objectives set by the future standards. To do so, the whole of the automobile industry is committing to the development of electric motors.

PACE OF CHANGE. Between now and 2030, a number of scenarios are possible, based either on a majority of hybrids or on all electric vehicles. There nevertheless seems to be an emerging consensus: sales electric vehicles will show significant growth from 2022-2023 onwards.

TECHNOLOGIES. There are many technological options to choose from: 100% electric, mild and full hybrid, rechargeable, etc. All the manufacturers are currently diversifying their ranges of drive systems. Toyota, for example, the leader in full hybrids, is developing pure electric projects. Renault and Nissan, pioneers in electric, are developing plans for rechargeable hybrid vehicles with their new partner, Mitsubishi. Diversifying these ranges means all the more work in R&D, and

CO2 EMISSIONS IN EUROPE ON THE RISE AGAIN

CO_2 emissions are at 118.1 g of CO_2/km on average in Europe (+0.3 over 2016), for an objective of 95 g of CO_2/km in 2021. There are two possible explanations :

- the effect of declining sales of diesel vehicles that emit approximately 20% less CO2 than petrol vehicles,
- the success of SUVs and crossovers, heavier and less aerodynamic than sedans.

GLOSSARY: ELECTRIC VEHICLES

MHV (Mild Hybrid Electric Vehicle): the combustion engine works full time and the electric motor assists it when starting up and accelerating. The battery recharges when braking. This system helps to bring down CO2 emissions by between 15 and 20%de, but it cannot power the vehicle on its own.

FHEV (Full Hybrid Electric Vehicle): the vehicle is equipped with two motors, one electric the other a combustion engine, which function either separately or together. The battery recharges when braking and its capacity determines usage of the electric motor (generally low range).

PHEV (Plug-in Hybrid Electric Vehicle) : the battery is recharged when plugged into the electricity grid. The electric motor and the combustion engine are both used to power the vehicle.

REX-EREV (Extended Range Electric Vehicle): rechargeable electric vehicle fitted with a small auxiliary combustion engine to recharge the batteries while driving

BEV (Battery Electric Vehicle): base de données de masse (volume) issues des informations émises à travers les actions numériques quotidiennes de tout un chacun

FCEV (Fuel Cell Electric Vehicle): electric vehicle fitted with a hydrogen tank that uses a fuel cell to generate the power needed to drive the vehicle

ICE (internal combustion engine): 100% fuel powered engine

the costs that go with it. That is the reason why partnerships are being set up wherever the players believe that they have more to gain by buying or jointly developing, rather than finding a solution in isolation. Daimler, for example, has approached Renault for small combustion engines and electric motors.

The final technological choices have not yet been made. They will very clearly depend on the evolution of batteries (reduced production costs, management of rare materials, range, recharging times) and alternative technologies (fuel cells, for example) as yet in the experimental stage.

MANUFACTURERS' PLANS FOR MOTORS

	Short term	Outlook
Renault	Reduced range of diesel engines	2022: produce one electrified vehicle in two and one in 5 as 100% electric
VAG	Replacement in 2020 of small diesel engines by small, mild hybrid petrol engines	2030: all group models to be available in electric versions (€20 billion)
BMW	Replacement in 2020 of small diesel engines by small, mild hybrid petrol engines	Bring one 100% electric engine and 5 rechargeable hybrid engines into the range. Research into a fuel cell powered model
Daimler	Partnership with Renault for small diesel and petrol engines. Move to 48 volts	
Ford		$4.5 billion electrification plan covering 13 models to be launched in 2027
PSA	New version of DVR diesel engine	Launch of 7 rechargeable hybrid models in 2021, then 5 100% electric models
Toyota		Combustion engines stopped in 2050 (simple and hybrid)
FCA	Small diesel engines stopped in favour of hybrids	2018-22 plan mentions electrification of the group's brands

CONTACT

FRANCE
> ag.lefeuvre@syndex.fr
> e.palliet@syndex.fr
> m.sonzogni@syndex.fr

BELGIUM
> f.warneck@syndex.eu

POLAND
> darteyre@syndex.pl

ROUMANIA
> s.guga@syndex.ro

SPAIN
> j.serrano@syndex.es

UK & IRELAND
> s.portet@syndex.org.uk

SYNDEX > AUTOMOBILE
Syndex, 22, rue Pajol - CS 30011 - 75876 Paris Cedex 18 / www.syndex.fr
Directeur de publication : Olivier Laviolette / Coordination : Service communication/documentation
Crédits photos : VisualHunt
Ont contribué à ce numéro : Anne-Gaëlle Lefeuvre, Emmanuel Palliet, Michel Sonzogni / Contact : Michel Sonzogni (02 41 68 97 81)