Changing vehicle mix vital for car makers to meet 2020-21 EU emissions targets

Car makers are on track to meet more stringent EU carbon emission targets in 2020 and 2021, helped by a subsidy-fuelled boom in electric vehicle sales, pooled carbon-dioxide credits and incremental gains in conventional engine technology.

Original equipment manufacturers (OEMs) still have some work to do to hit targets for average carbon dioxide (CO_2) emissions for their vehicle fleets in 2020-21. We believe that OEMs will invest sufficiently in bringing to market and promoting vehicles with low-emission technology – mostly plug-in hybrid electric vehicles (PHEVs) rather than battery-electric vehicles (BEVs) - so that the share of BEVs/PHEVs in the sales mix this year and next is sufficient to avoid EU fines. Helping them is the flexibility built into the EU regulations offering indirect ways of reaching the targets through pooling emissions performance and gaining credits for approved emissions-reducing innovations.

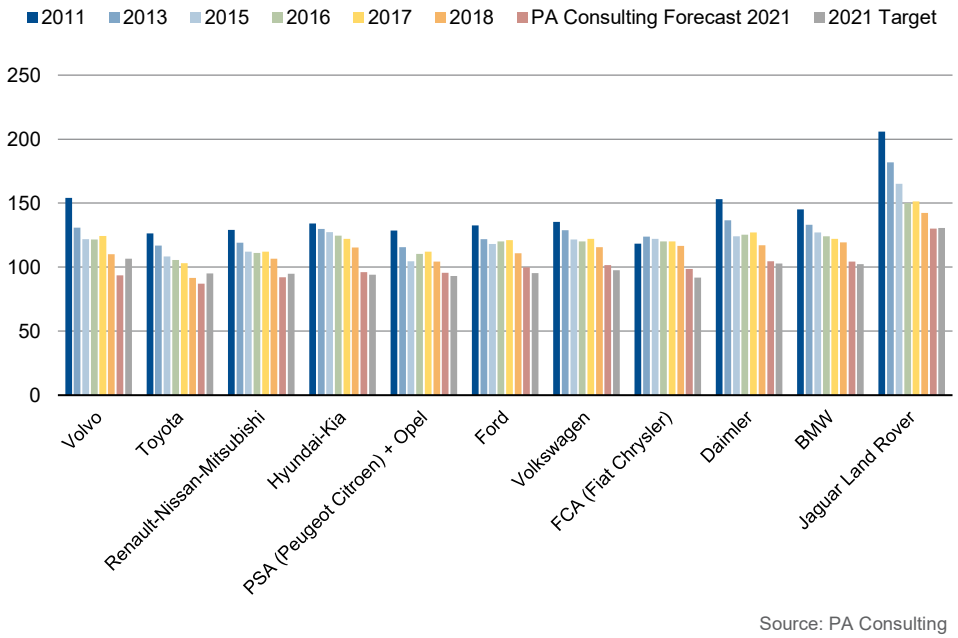
Car makers are pursuing similar strategies for CO_2-compliance, including the expansion of their offering with mild hybrid (48V) technology, including more PHEVs in their model line-ups, and launching new BEVs in addition to taking advantage of the other provisions in the EU regulations to indirectly meet emissions targets.

Sales of electrified vehicles boomed in the first half, representing 8% of all vehicles sold in the European Economic Area – EU member states, European Free Trade Association members and the UK – a tripling in volumes from the same period in 2019.

The increased share of electrified vehicles in the mix, largely supported by generous subsidy schemes, has led to a substantial decline in auto makers' fleets average CO_2 emissions. According to recent estimates, new car CO_2 emissions in the first half dropped to 111 g/km from around 122g/km in 2019. The EU's 2020/21 target is 95g/km.

Car makers have effectively achieved a reduction in CO_2 for every new car equivalent to about half of the reductions achieved in 2010-2016 combined, the period before the boom in sales in sport utility vehicles (SUVs) that led to slightly rising average CO_2 emissions in 2017-2019.

Figure 1: Average CO_2 emissions in g/km vs target



Source: PA Consulting

Analyst

Werner Stäblein
+49 69 6677389 12
w.staeblein@scoperatings.com

Editor

Matthew Curtin
+33 1 8626 1554
m.curtin@scopegroup.com

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Scope Ratings GmbH

Lennéstraße 5
10785 Berlin

Phone +49 30 27891 0
Fax +49 30 27891 100

info@scoperatings.com
www.scoperatings.com

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Share of 5%-7% of BEV/PHEV to meet 2020 target

The significant demand for PHEVs/BEVs in Europe should continue until the end of the year providing further support for OEMs in achieving the emissions targets. OEMs need PHEVs/BEVs to make up around 5%-7% of the European market for that to happen. With some government subsidies effective only from the middle of 2020, OEMs should benefit from a rising share of electrified vehicles sold in the second half, putting aggregate sales above the minimum needed.

Transport & Environment data suggests compliance doable

For individual auto makers, BMW AG faces a low risk of being non-compliant with emissions targets in 2020 while rival German OEMs Daimler AG (A/Stable) and Volkswagen AG still face some challenges in second half, according to initial calculations by Transport & Environment, a European clean-transport association. We see PSA Group – which owns Opel – in the clear while Fiat Chrysler Automobiles' purchase of credits from Tesla Inc. will ensure it avoids penalties.

The risk is reputational

We firmly believe that German OEMs will not risk reputational damage in non-compliance with the 2020 targets and use every strategic option available to meet them. Volkswagen, for instance, has recently announced an emissions-pooling agreement with Chinese joint venture partner SAIC Motor as a back-up if sales volumes of PHEVs/BEVs disappoint during the rest of the year.

Emission legislation (CO_2) in Europe

Earlier goals were met through reliance on diesel

The EU introduced first CO_2 targets for fleet sales in 2009 with a fleet-wide average of 130g/km CO_2 emission to be reached by 2015. All OEMs complied with that target, by increasing the share of diesel-powered vehicles in the sales mix and improving fuel economy with smaller engines, low rolling resistance tyres, and lightweight components.

The EU set significantly more demanding targets for 2020/2021. The fleet-wide average CO_2 threshold fell to 95g/km for 2020/2021. This is equivalent to a fuel consumption of about 3.5 litres of diesel or 4 litres of petrol (per 100km).

Penalties for emissions above EUR 95/g threshold

If an OEM does not achieve this target, the manufacturer incurs a penalty of EUR 95 for every gram and vehicle above the target. The target of 95g/km is adjusted for each OEM depending on the difference between the average fleet mass of the OEM for a given year and the reference mass that corresponds to the average mass of the EU fleet. Therefore, every OEM has a slightly deviating target from the 95g/km. The 95g/km target is based on the New European Driving Cycle (NEDC) test cycle. Since Sept. 2018, carbon dioxide emissions for newly registered vehicles are measured with WLTP (Worldwide Harmonised Light Vehicle Test Procedure) and test results are converted back into a NEDC equivalent using a mapping developed by the European Commission.

In 2020, 95% compliance with EC regulation needed

The target for 2020 is a 95% compliance with 95 g/km average fleet emissions - i.e. the 5% worst-performing of new vehicles sold are not considered in the calculation of emissions compliance – while the regulation requires full compliance for 2021.

Legislation to become even tighter by 2025 and 2030

In Oct. 2018, the EU council of environmental ministers decided to tighten distance-specific CO_2 emissions for passenger cars and vans for the period beyond 2021 even further. New EU fleet-wide targets foresee a reduction of CO_2 by 15% until 2025 and 35% until 2030 for passenger cars (15% lower by 2025 and 30% lower by 2030 for vans). In each case, the starting point is the fleet average emissions value in 2021.

SUV factor: average European CO_2 emissions have risen recently

Average emissions of new passenger cars rising recently

According to provisional data published by the European Environment Agency (EEA), the average carbon dioxide emissions from new passenger cars registered in the European Union in 2018 (the latest data set available) increased for the second consecutive year, reaching 120.4 grams of CO_2 per km (after an increase 1 g/km to 119 g/km in 2017). This

increase of average CO_2 emissions follows the marked reduction of carbon dioxide emissions by about 22 grams/km in the period 2010-2016.

Popularity of SUVs explains rise in emissions

One of the reasons for the difficulties that OEMs face to achieve the 2020/2021 carbon dioxide emissions target is the continued popularity of sport-utility vehicles (SUVs) among customers and a limited model range of electric vehicles (PHEV/BEV).

Regulation catalyst for in accceration in BEV/PHEV rollout

The limited model range of BEVs and PHEVs is partly attributable to the fact that any such "lower-emission" vehicles did not have any regulatory benefit prior to 2020/2021. Car OEMs have announced a series of product launches (PHEV/BEV) for 2020 and 2021. Timing and market launch of these vehicles is clearly connected to the 95 g/km target.

Popularity of SUVs undimmed by environmental concerns

Diesel cars have a better CO_2 performance with 15%-20% lower CO_2 emissions relative to petrol cars due to lower fuel consumption (higher energy density of diesel). The shift towards (compact) SUVs has, however, closed gap between petrol and diesel vehicles. The increasing share of SUVs, now representing about 35% of the market versus less than 10% in 2010 has led to higher absolute carbon dioxide emissions of petrol cars. Most new SUVs sold are powered by petrol, with average emissions of 133 g/km of CO_2 (2017 data). This is around 10 g/ CO_2 higher than the average emissions of other new petrol cars. Carbon dioxide emissions vary by vehicle type. As a reference, in the premium medium segment vehicles such as the MB C-class (112 g/km) or a Volkswagen Golf (107 g/km) in the small segment have significantly lower emissions. The average CO_2 of diesel vehicles (121.5 g/km of CO_2) is now very close to the average for petrol cars (123.4 g/km). The difference of 1.9g CO_2 was the lowest observed in the past five years and the narrowing difference between diesel and petrol reflects the gradually rising emissions of petrol cars.

Car buyers pay little heed to emissions

The slowdown of OEMs average fleet emissions is, therefore, not only influenced by the lower "dieselisation" in the fleet and partly reflecting consumers' decisions to give increasingly less consideration to CO_2 when purchasing a new vehicle. The public debate about global warming and greenhouse gases is clearly not reflected in consumers' choices for new vehicles and OEMs sales statistics speak the opposite language of what public perception appears to be of good "environmental behaviour."

Weight of vehicles has grown consistently – the SUV effect

Data from the International Council for Clean Transportation (ICCT) show that the weight of cars sold in Europe over the period 2001-2016 has grown by about 10% (124 kg/vehicle in absolute terms). This happened despite OEMs continuous efforts to use more light-weight materials such as aluminium for engine blocks to reduce vehicle weight (and carbon dioxide emissions as a result). Heavier average vehicles reflect the popularity of SUVs in customers' choices but in turn also shows that the individual CO_2 profile of vehicles has played an unimportant role in most purchasing decisions over time.

In the same period (2001-2016), the (horse-)power of new cars increased by 28% with effects on absolute levels of consumption. The European Environment Agency (EEA) concluded that the increased vehicle weight has led to an average increase of 10g/km of CO_2) including the effects of stronger vehicle engines. This is about in line with European Aluminium Association's estimates that a mass saving of 100kg per vehicle can deliver an average saving of 5.4g CO_2 for a vehicle powered with a conventional internal combustion engine.

Without SUVs, OEMs would be 10g/km closer to EU target

Based on the most recent data available (2018) from PA Consulting, most OEMs are about 15 g/km off their respective vehicle-weight adjusted targets with the exception of Hyundai Motor Company (Hyundai-Kia, about 19 g/km) and Fiat Chrysler Automobiles N.V. (18 g/km). OEM-specific vehicle-weight adjusted targets vary from about 93 g/km for PSA to 105 g/km for premium OEMs such as BMW AG or Daimler AG. What's clear is

that OEMs would be about 10 g/km closer to the target if the share of SUVs in the mix had now increased markedly over time.

BEV/PHEV sales to offset SUV boom in curbing emissions

Annual improvements in CO_2 reduction were about 2%-3% prior to 2016, i.e. the period when average fleet emissions started rising again as a result of the "SUV-effect". A massive reduction of individual OEM targets towards their respective goals in the next two years can only be reached with a higher share of low-emission (PHEV/BEV) vehicles.

Regulatory flexibility: the wild cards to achieve CO_2 targets

Super-credits and eco-innovations play important role

The 2020/2021 regulation has two "flexibilities" for OEMs to achieve their respective CO_2 targets:

- super-credits
- eco-innovations

Super-credits

Low-carbon vehicles receive greater weight in regulation

Super-credits are a multiplier of the number of low-carbon vehicles sold in order to give them a greater weighting in the final calculations of average fleet emissions (low-carbon vehicles are cars and vans with CO_2 emissions lower than 50 g/km on the NEDC test cycle, effectively PHEV and BEV). The super-credit factor is set at 1 today but will be set at 2 in 2020 and 1.67 in 2021. The super-credit flexibility is capped at a maximum claim of 7.5 g/km CO_2 for each manufacturer over the period of the regulation (2020-2021).

Only modest sales with BEV&PHEV needed to hit goals

T&E estimated that at the EU level to earn a moderate level of super-credits (3.5 g/km) about 1.5% of fleet sales would have to be zero-emission vehicles and 2.5% PHEVs in 2021 (1.2% BEV in 2020 and 2.0% PHEV in 2020). For the maximum of super-credits (7.5 g/km), sales of zero-emission vehicles would need to be 3% and the share of PHEV about 5% in 2021.

OEMs need BEV/PHEV sales to make up 5-7% of total volume

All estimates and calculations point to a 5%-7% share of BEV/PHEVs to be sold be European OEMs to avoid a burden from the CO_2 regulation. In view of the rising preference for SUVs (and impact on vehicle weight including emissions), this percentage may turn out to be slightly higher.

eco-innovations

Further flexibility on carbon targets through eco-innovations

The idea of eco-innovation flexibility was introduced in 2011 to encourage manufacturers to develop advanced CO_2-saving technologies. This flexibility is capped at a maximum of 7g CO_2/km for each manufacturer. The European Commission has approved more than 25 innovations which, once fitted on vehicles, OEMs and their suppliers can use to claim reduced carbon dioxide emissions.

Eco-innovations play a role with rising fitment rates

Eco-innovations reward innovative technologies with CO_2 reductions beyond the outcome that is measured in the standardized test cycle. Efficient alternators (Robert Bosch GmbH/Valeo S.A.) or LED lighting (Hella) are on the list of approved eco-innovations. Average emission reductions in vehicles with eco-innovations were significant at 1.5 g/km but fleet average CO_2 savings were lower because of the market penetration of these technologies. Eco-innovations have a low impact on brand-average fleet emissions, less than 0.1 g/km in most cases, but eco-innovations could significantly contribute to manufacturers' efforts to meet 2020/2021 and 2025/2030 CO_2 targets if they are installed in more vehicles in the future. CO_2 reduction individually per vehicle can be high (e.g., alternator reduces by 1.4 g/km, LED lights by 1.0 g/km) but fleet-average reduction has proved low due so far due to the low penetration rates of the technologies.

Incurring costs rather than fines to meet emissions targets

Estimates on potential fines for not achieving the average carbon fleet emission targets in 2020/2021 differ. In its latest calculations (based on 2018 registration data), PA Consulting, estimated high triple-digit EURm fines for Groupe PSA, Fiat-Chrysler Automobiles (FCA), the Hyundai-Kia group and lower amounts for Daimler, BMW, Mazda

Motor Corp., with Volkswagen AG at a higher risk. We believe that estimating potential fines serves little purpose as auto makers will prioritise low-carbon vehicles to the greatest extent possible to avoid penalty payments, effectively changing the cost item from "fine" to "selling expenses" with identical impact on the bottom line.

Eco-innovations play important role at Volkswagen

With a moderate use of eco-innovations in vehicles sold, T&E concludes that Volkswagen is at no risk of fines in 2021, contrasting the PA Consulting estimates. The potential financial cost of complying with the 2021 targets is in the low low-triple-digit to mid-triple-digit EURm amounts for carmakers assuming that OEMs make use of eco-innovation flexibility.

Fiat Chryser used option to pool emissions – with Tesla

The OEM most at risk for a higher burden is Fiat Chrysler (FCA) where T&E estimated a fine of EUR 700m - or more likely, in our view, EUR 700m in extra costs as management will emphasise sales of low-emission vehicles to avoid the penalty. FCA has made use of the option to create an "open pool" with other car OEMs with regards to the emission targets. In April 2019, FCA and Tesla Inc. agreed to pool their fleet for the purposes of CO_2 targets in Europe – this should effectively lead to a reduction of FCA's CO_2 risk at the expense of compensating Tesla for its zero-emission contribution to the pool. FCA has not disclosed its payment to Tesla – presumably based on sales in 2020 and 2021 - but we would put it at a mid-single-digit EUR million amount.

Toyota pools vehicles with Mazda

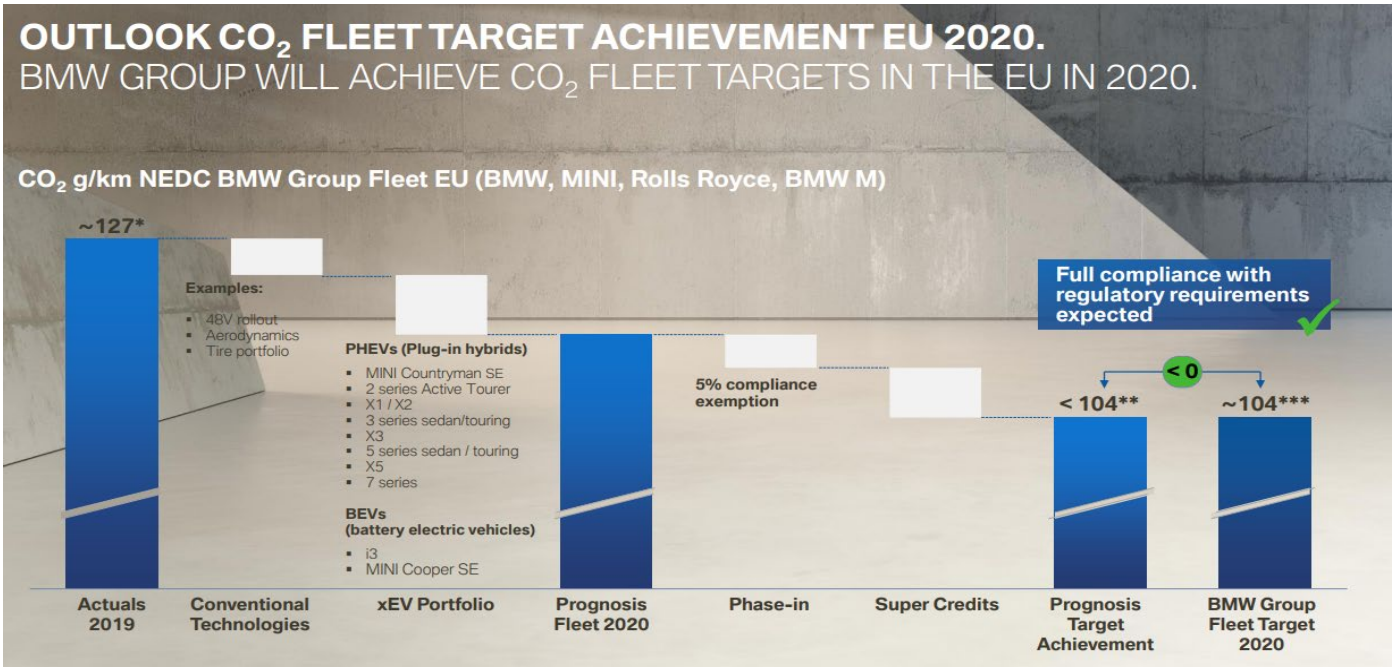
Toyota has likewise created and open pool with Mazda, supporting Mazda in the achievement of its individual target. Opel would have had issues to meet its CO_2 target but following the acquisition of Opel by PSA, the combined company should face lower burdens from the 2020/2021 thanks to PSA's low average fleet emissions.

German OEMs strategies towards CO_2 targets in 2020

German OEMs use blend of options to reach targets

Carmaker are pursuing a blend of options to reach the 2020/2021 targets. Conventional technologies that have been used so far such as improved engine efficiencies, downsizing, or lightweight materials are now supplemented by the 48V mild hybrid technology (see info box below) which allows OEMs fit cars with smaller engines but better fuel economy and performance.

Figure 2: BMW's plans to achieve the 2020 emission target



Source: BMW Group Investor Presentation, Sept. 2020

The key lever to achieve 2020 targets, however, is the extended availability of plug-in hybrid vehicles. The combination of lower emissions of petrol-powered vehicles (notably with the 48V technology), substantially rising share of PHEVs, the use of super-credits, eco-innovations and 5PP phase-in compliance exemption should bring most OEMs close to the 2020 target with some OEM potentially over-achieving the target.

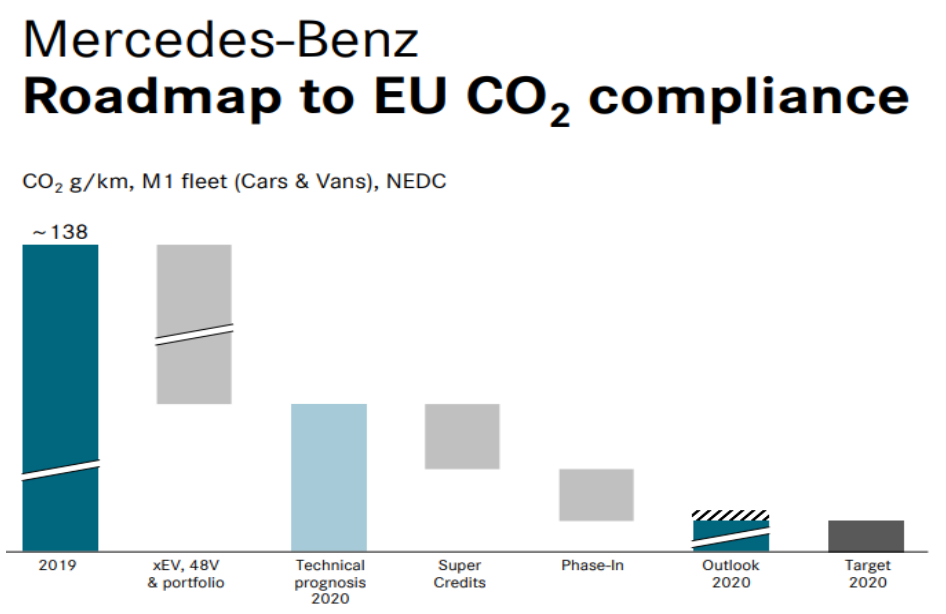
BMW 's PHEV sales in H1 puts OEM on right emissions track

Using T&E data, BMW's H1 unit sales (9%: PHEV; 3.5% BEV) put the group on track for the EU's 2020 target. With more unit sales of the PHEV versions of 2-, 3-, 5-, and 7-series and SUVs (X1, X5) expected before end-2020, BMW faces a low risk of non-compliance with 2020 targets. In view of the new EV purchasing subsidies mid-year, BMW's H2 unit sales of PHEV/48V vehicles should exceeds H1 volumes which may even provide a buffer or more flexible use of super-credits.

Daimler faces more challenges but H2 PHEV sales could help

While the strategy to achieve 2020 targets at Daimler is similar to those of other OEMs, namely the introduction of the 48V technology for vehicles with internal combustion engines and expansion of the PHEV portfolio, Daimler is still facing a challenge in 2020 to achieve the targets. In its recent capital markets day (Oct. 2020), Daimler's management said that the current run-rate of PHEV/48V vehicles sold is suggests to be "within striking distance of achieving the target" but that the achievement of the 2020 target would require a strong unit sales volume of PHEV/48V in 4Q20.

Figure 3: Daimler's plans to achieve the 2020 emission targets



Source: Daimler Capital Markets Day, Nov. 2019

Daimler may rely on customer incentives to boost EV sales

Daimler (Mercedes-Benz cars) will have to close an estimated gap of 9g/km to achieve the 2020 target, according to T&E. We believe that OEMs including Daimler will use every strategic option available to meet the 2020 targets. This could include higher incentives for "compliance vehicles" in second half (on top of the governmental subsidies available to vehicle buyers) and the limitation of sales of the highest-emitting vehicles such as the G-class, GLE and AMG GT. Even if the 2020 target was missed by 1 g/km or 2g/km, a potential "fine" would not be relevant from a credit perspective, reiterating our view that OEMs including Daimler will prefer to avoid the brand damage and to "give away" the value of potential fine in additional incentives for its low-emission vehicles – for the same economic cost.

Changing vehicle mix vital for car makers to meet 2020-21 EU emissions targets

New VW ID.3, Skoda, Seat BEVs to drive emission reduction

Volkswagen's compliance strategy for the 2020 CO_2 targets partly rests on future sales of recently introduced BEVs across its brands, including Skoda's ENYAQ, Seat's el-Born and VW's ID.3 and ID.4. All vehicles are built on Volkswagen's EV platform (Modular Electrification Toolkit), the technological backbone for fully electrified vehicles due for launch in the next few years. T&E estimates that Volkswagen will have to close a gap of about 5 g/km to achieve the 2020 targets based on the sales mix (BEV, PHEV, ICE) in the first half. With the ramp-up of BEV sales towards the second half of 2020, further improvements in average fleet emissions at Volkswagen appear reasonably achievable.

Volkswagen using pooling as a safety net

Volkswagen said in September that it had agreed with Chinese joint-venture partner, SAIC Motor and its subsidiary MG Motor to set up an "open pool" (similar to the FCA-Tesla, Toyota/Mazda pools). Financial terms were not disclosed. Volkswagen described the agreement as "an insurance policy" in terms of the 2020 emission target. Volkswagen will benefit from unit sales of MG's model "ZS", a small BEV SUV offered in selected European countries and the MG5 PHEV, a compact station wagon. MG Motors sold 3,600 BEVs in H1 (UK, Norway, Netherlands), with plans to roll out model in Germany, Spain, and Italy in H2, thereby contributing zero-emissions vehicles to the Volkswagen/MG Motors "open pool" and lower average fleet emissions in 2020. If the ZS unit sales lower Volkswagen's average fleet emission by "only" 0.5-1.0 g/km, this would constitute about 20% of the remaining estimated 5 g/km to be achieved until year-end.

The 48V mild hybrid

The 48V mild hybrid is a lithium-ion battery recharged through regenerative braking or an alternator. There is no charging of the battery at a wall socket/charging station. Therefore, the 48V mild hybrid is not a "hybrid" in the pure sense but the 48V technology is used by OEMs for marketing purposes. For example, Volvo Cars announced in 2018 "the full electrification of its products by 2019" but most of Volvo's models are 48V hybrid technology combined with an internal combustion engine.

The 48V battery is an add-on to the well-known 12V battery in a vehicle which does not does not support independent powering of the vehicle. The 48V battery is an energy source for functions such as HVAC (heating, ventilation, and air conditioning), electronics and chassis control. Some advanced 48V battery solutions can support independent cruising, i.e.: without using power generated by the internal combustion engine.

The 48V hybrid can reduce fuel consumption by 10%-20% and thus reduce CO_2 emissions.

Valeo SA, an auto supplier that offers 48V solutions, estimates that 48V mild hybrids offer 70% of the benefits of a full hybrid (PHEV) at only 30% of the cost. Hella GmbH & co. KGaA estimates comparable cost/benefit relationships of 48V mild hybrids vs. full hybrids. The cost of a mild hybrid is about EUR 1,000 more in components relative to the cost of a diesel engine. Overall, the cost of the 48V mild hybrid solution is roughly the same as the cost of a diesel engine when 48V battery is added to a petrol engine.

The 48V mild hybrid solution is therefore a benefit for diesel engines (lower consumption = lower CO_2) offering significantly lower NOx emissions and will thus help car makers achieving their EU CO_2 goals in 2020/2021.

Auto suppliers active in the 48V market are: Hella (48V DC/DC converters), Continental AG (48V DC/DC converters & starter generators), Valeo (48V DC/DC converters, starter generators, electric rear axle drives) or BorgWarner Inc. (48V DC/DC converters, electric axles, and 48V eBoosters).

Scope Ratings GmbH

Headquarters Berlin
Lennéstraße 5
D-10785 Berlin

Phone +49 30 27891 0

Frankfurt am Main
Neue Mainzer Straße 66-68
D-60311 Frankfurt am Main

Phone +49 69 66 77 389 0

Paris
23 Boulevard des Capucines
F-75002 Paris

Phone +33 1 8288 5557

London
3rd Floor
111 Buckingham Palace Road
UK-London SW1W OSR

Madrid
Paseo de la Castellana 95
Edificio Torre Europa
E-28046 Madrid

Phone +34 914 186 973

Milan
Regus Porta Venezia
Via Nino Bixio, 31
20129 Milano MI

Phone +39 02 30315 814

Oslo
Haakon VII's gate 6
N-0161 Oslo

Phone +47 21 62 31 42

info@scoperatings.com
www.scoperatings.com

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