POSITION PAPER

EUROWAG

ON THE ROAD TOWARDS CLEAN MOBILITY

JANUARY 2020

eurowag.com

ABOUT EUROWAG

Founded just over 20 years ago, EUROWAG is today the fastest growing integrated mobility provider in Europe. We focus on finding solutions that simplify the lives of commercial road transport companies. Whether it's fuel and toll payments, tax refunds, fleet management or simply advice – we are here to help our customers keep over 250,000 vehicles moving across Europe, Asia and the Middle East.

INTRODUCTION

Climate change, seemingly humankind's biggest ever challenge, has triggered a vast number of responses. Europe is the continent most committed to the deployment of various measures intended to lead to the effective prevention of a global catastrophe. Industries with the biggest carbon footprint, including the mobility sector, are at the centre of attention, as carbon dioxide is believed to be the main cause of climate change.

The public demand for quick and decisive systemic actions has resulted in a set of legislative measures on the European level which, however, ignore or omit a whole set of challenges and problems. This is not yet obvious, but if clean mobility is to be deployed at scale, effectively, and within a time frame matching the Paris climate conference targets, these challenges must be urgently acknowledged – and mitigated – by policymakers. One of the key initiatives to achieve this is the "European Green Deal," a strategic document presented by the EU Commission.

The risk of proliferating risks is immense, and it is becoming clear that time really matters. Investments made by key European industries affecting millions of jobs and requiring billions of euros would be endangered if it were later to be revealed that current strategies are not viable, or objectively miss their targets.

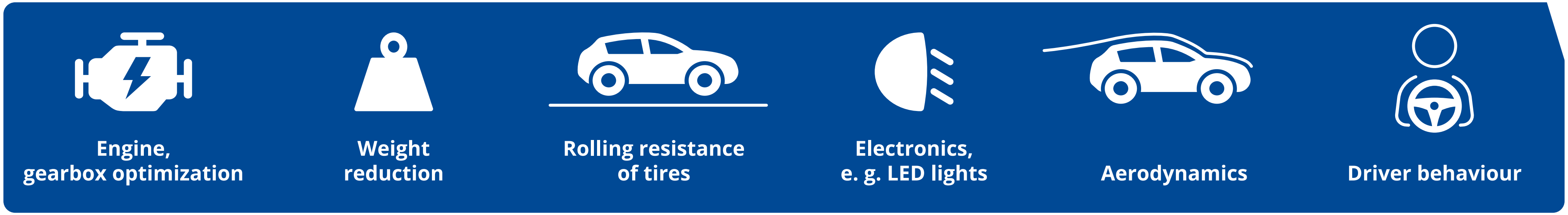
Therefore, EUROWAG has created this document to contribute to an unbiased discussion concerning clean mobility and to help the effort to find the most efficient and effective solution.

HOW TO REDUCE
CO_2 EMISSIONS

1. THE CONVENTIONAL APPROACH

When it comes to conventional internal combustion engine (ICE) vehicles, car manufacturers focus on the following technical measures for reducing CO_2 emissions.

The problem with this conventional approach is that it is reaching its technical limits: cars cannot be made ever smaller, lighter and more aerodynamic, nor can they be equipped with tyres that have ever less rolling resistance



2. ALTERNATIVE POWERTRAINS

The alternative powertrains mainly operate on:

GAS

- Compressed or liquified natural gas (CNG, LNG, including their ‘bio’ variants)
- Liquefied petroleum gas (LPG)

ELECTRICITY

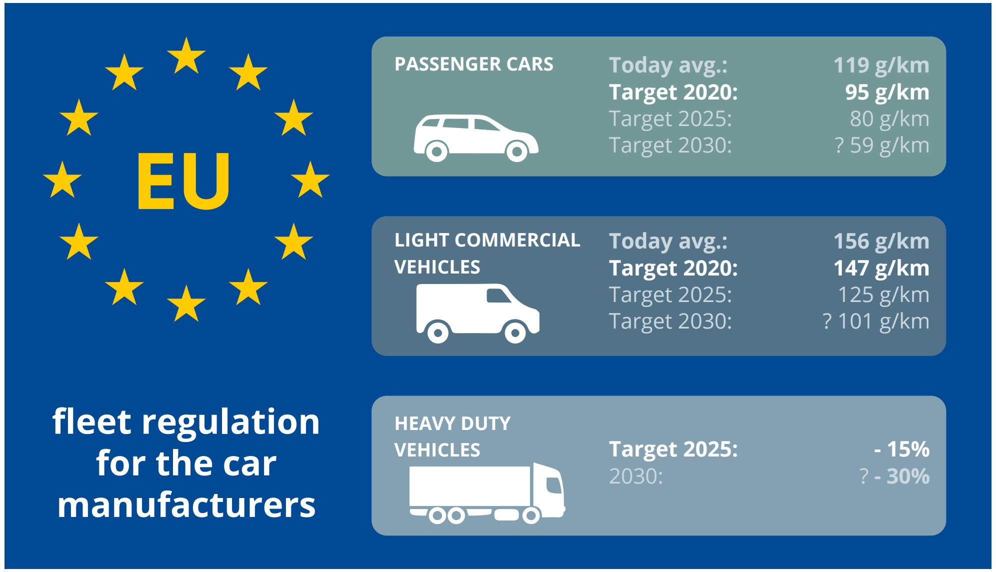
- Plug-in hybrid electric vehicles (PHEV)
- Battery electric vehicles (BEV)
- Hybrid electric vehicles (HEV) – electricity is generated by an ICE

HYDROGEN

- Fuel cell electric vehicles (FCEV)

THE EU'S CURRENT CLEAN MOBILITY STRATEGY

In the European Union, there are currently a number of regulations and supporting measures aimed at reducing CO_2 emissions[1], as well as other greenhouse gases, among which the following measures are considered to be crucial:



1. **EUROPE-WIDE CO_2 LIMITS FOR VEHICLE MANUFACTURERS RELATED TO YEAR-ROUND SALES IN THE EU**
   EU legislation addressing passenger vehicles (Regulation No. 2019/631, sometimes referred to as the "95g legislation") sets mandatory, not-to-be-exceeded emission limits, calculated from the average fleet emissions of cars registered by vehicle manufacturers in EU countries in a given year. In 2020, a radical tightening of this legislation in the field of passenger and small commercial vehicles will apply. As confirmed since early 2019, one of the most challenging tasks in reducing CO_2 emissions applies to heavy duty vehicle (HDV) manufacturers and extensive penalties will apply if they do not comply with the targets.

Very tight deadlines do not allow for the introduction of vehicles with alternative powertrain technology to be postponed until the related infrastructure is ready, or until customers start to show an interest. On the contrary, manufacturers have no choice but to transform production and sales channels to produce and sell vehicles with electric, hybrid, but also hydrogen and gas drives, in significant numbers. The situation for truck manufacturers is even more challenging, given the longer development cycles for new generations of vehicles and the as yet very limited infrastructure for charging such vehicles or for refuelling them with LNG or hydrogen.

Although the EU legislation is the most strict, comparable methodology for CO_2 emission limits is being applied in

1 Global emissions increased from 2 billion tonnes of carbon dioxide in 1900 to over 36 billion tonnes 115 years later. Fuel combustion and fugitive emissions from fuels, together with transportation, is the main source sector for greenhouse gas emissions.

China, the USA, India, Japan, South Korea and other countries.

2. **REGULATION AND SUPPORT AT THE EU MEMBER STATE LEVEL TO FAVOUR LOW OR ZERO LOCAL EMISSIONS VEHICLES COMPARED TO CONVENTIONAL VEHICLES**
   Some EU member states have introduced incentive/penalty schemes with high tax or fee burdens placed on the sale and operation of conventional vehicles and, at the same time, mechanisms to support the purchase and operation of low-emissions vehicles (mostly BEVs and PHEVs).

3. **URBAN EMISSIONS-FREE OR LOW-EMISSIONS ZONES AND LOCAL NON-FINANCIAL INCENTIVES**
   A rising number of municipalities have begun restricting entry to city centres for cars with higher emissions, or now offer preferential parking for low/zero emissions vehicles. However, other financial and non-financial incentives and regulations also exist.

4. **EU COMPULSORY QUOTAS FOR PUBLIC INSTITUTIONS, MUNICIPALITIES**
   A revision to the Clean Vehicles Directive introduces minimum procurement targets for public institutions of individual EU member states concerning the purchase of low/zero emission vehicles[2]. The targets become effective as of 2021.

5. **RENEWABLE ENERGY DIRECTIVE (RED II)**
   According to this revised directive, member states must require fuel suppliers to supply a minimum of 14% of the energy consumed in road and rail transport by 2030 in the form of renewable energy. Energy suppliers must reduce by 6% the emissions from fuels they supply by 2020 compared to 2010.

6. **OTHER MEASURES**
   These include, for private and corporate persons: reduced/zero road tax, free highway vignettes, city tolls, priority lines in cities, taxes on the private use of company cars, compulsory installation of charging points in new buildings, and many more.

DID YOU KNOW?

Trees capture only around **10%** of the total CO_2 we emit annually. By switching to alternative fuels to reduce CO_2, we help to process additional emissions.

2 E.g. the quota for the Czech Republic is 29.7%, and for Germany it is 38.5%.

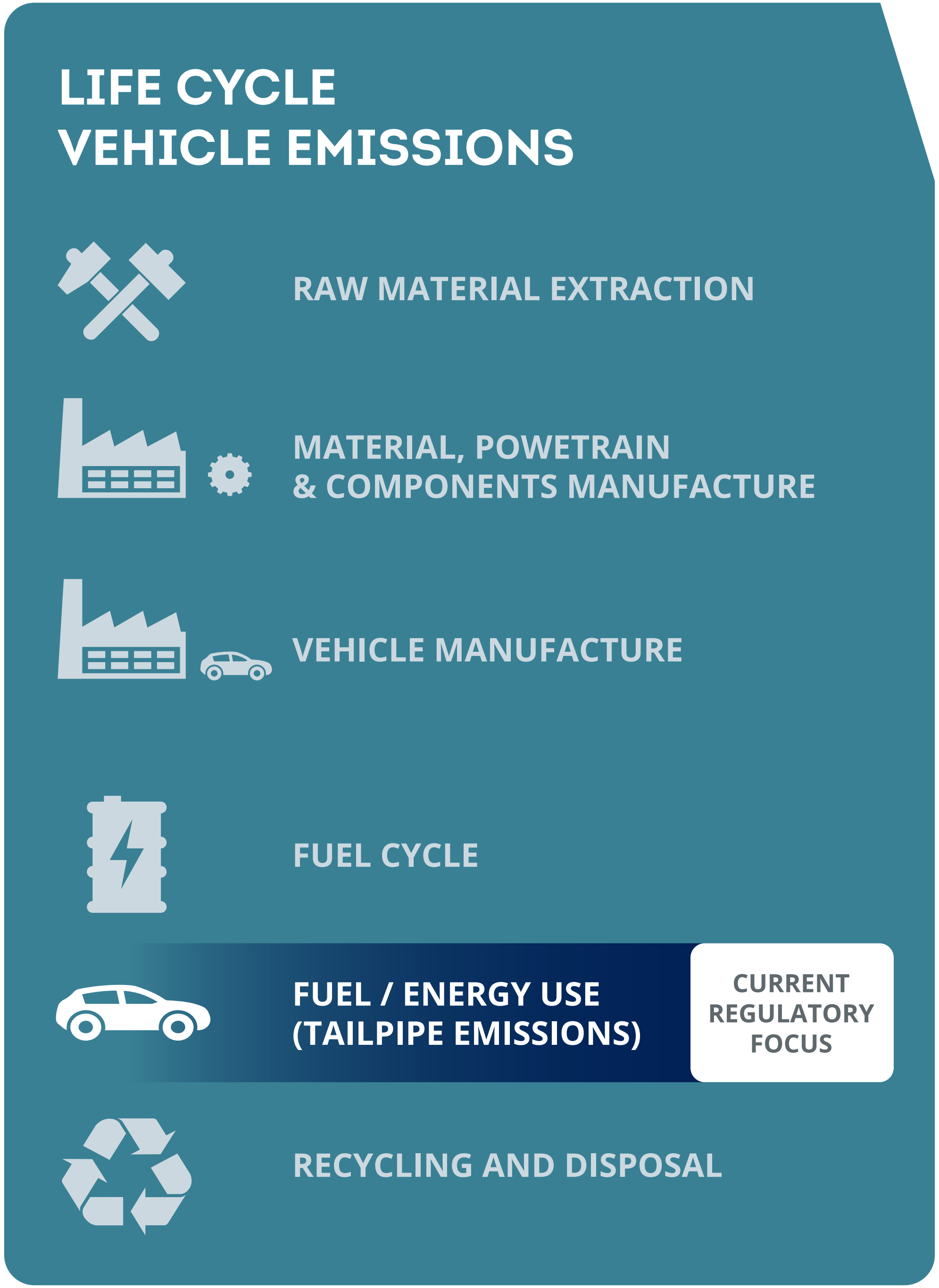
CHALLENGES AHEAD

1. ABSENCE OF AN HOLISTIC, INDUSTRY-WIDE APPROACH TO CO_2 REDUCTION

1.1. Key legislative measures as well as mainstream media communication focus on reducing CO_2 emissions from the tailpipe. However, only an approach that considers entire life-cycle emissions can objectively deliver results. For electric cars this, among others, includes electricity production and distribution, battery production, and recycling. At the same time, other aspects affecting ICE (internal combustion engine) cars must also be considered, among them crude oil production and refining, its transport to petrol stations, and others. These elements in the whole cycle create considerable secondary CO_2 emissions that need to be taken into account.

Therefore, we urgently call for transparency and the adoption of a holistic approach. This requires not only promotion of existing EU legislation, but coordinated efforts by players across the mobility sector.

1.2. Another deficiency of the current methodology used to calculate CO_2 emissions by passenger and commercial vehicles in the EU is that it strongly favours electric and hydrogen/fuel cell vehicles that are, from the point of view of the legislation, considered to be emitting zero CO_2, completely ignoring the emissions generated when electricity or hydrogen is produced. This **excludes other**



alternatives (biofuels of the second generation, e-fuels[3], etc.), which eventually provide, when applying the holistic approach, an equal contribution to overall CO_2 reduction.

This technologically biased approach represents a huge risk and an immense lost opportunity, since these alternatives make it possible to use the extensive existing infrastructure – such as storage facilities, pipelines and fuel station networks. Specifically, the vast global capacity of liquid fuel tanks is a solution to the unresolved challenge of renewable electricity storage.

Finally, the very long cycle of fleet renewal is a definite time constraint. This could be immediately bypassed by introducing e-fuels, which can be used by conventional ICE vehicles.

2. BATTERY MATERIAL AVAILABILITY AND SECURITY OF SUPPLY

The raw materials[4] needed for batteries are currently mostly produced in unstable regions, putting the anticipated mass production of batteries at significant risk. Production of smartphones, laptops, etc. faces the same challenges. If electromobility is to be deployed at scale, problems with security of supply have to be carefully addressed.

3. BATTERY RECYCLING – ENVIRONMENTAL ISSUES

The durability of vehicle batteries often exceeds the life span of the vehicle itself and some used batteries can be used in stationary energy storage facilities or in other forms of utilisation – a so-called second-life use[5]. However, many of these batteries will be damaged or rendered non-functional and will not therefore be suitable for secondary use. Higher volumes of electric and hybrid cars will bring new challenges in terms of collecting such batteries from the market and recycling them. Continuous improvement in recycling technologies needs to be considered a priority in order to reinforce the positive ecological impact of battery-powered vehicles.

4. SOCIAL IMPACT OF CLEAN MOBILITY IMPLEMENTATION

Regardless of the final powertrain mix and the way in which clean mobility is to be implemented, it is obvious that such a massive transformation will come at a cost. Public budgets play a vital role during the initial phases. Users as well as affected industries are going to be keen to receive financial incentives to engage in the process at an early stage.

However, in view of the massive market uptake of alternative fuel vehicles in future, the required spending will go far beyond what governments can afford without negatively affecting other policy agendas, such as healthcare, education or

3 E-fuels = advanced renewable fuels produced from renewable electricity via electrolysis. These synthetic fuels are also known as e-petrol, e-diesel or e-gas. They can be produced using renewable (solar or wind) energy, water and CO2 taken from the atmosphere. They can also be mixed with conventional fuels and used in conventional (ICE) vehicles, thereby significantly reducing the CO2 emissions they produce.

4 Such as nickel, lithium and cobalt.

5 E.g. batteries can be used to store energy in homes or business premises.

security. Therefore, the costs will unavoidably be transferred to consumers.

Such an impact has to be thoroughly evaluated in the light of a globally shrinking middle class and a large portion of the population already struggling with poverty. In addition, these costs will come at the same time as others arising from the effects of climate change. Those two drivers will mutually reinforce each other's effects. Widespread social unrest and eventual societal collapse has to be prevented. The yellow-vest movement in France is a clear demonstration of this phenomenon.

5. FIRE PROTECTION AND INCIDENT RESOLUTION

The development of fire protection and car accident solutions for BEVs, PHEVs and FCEVs is still at an early stage. Fire brigades will need to become more involved to ensure that they can handle accidents and emergency situations. Adequate funding for equipment and training should be provided in a standardized form across the whole of Europe.

6. FUEL TAXATION NEEDS REVISION

The taxation of electricity used as a fuel in a traditional way, by which liquid or gaseous fuels are currently taxed, is technically hardly feasible (without being subject to fraud and complex IT / technical requirements). Hence, alternative taxation schemes need to be introduced, such as the introduction of tolls / road taxes mandatory for every vehicle at the European level. This approach may offer the desired flexibility and reliability at the same time. Various tax rates and schemes specific to the powertrain / weight / user / time, etc. may be introduced. Smart mobility tax systems can easily cover all the desired aspects, such as social impact management, environmental incentives, infrastructure cost coverage via the "user pays" principle, and others. Current taxation schemes do not incentivise renewable fuels sufficiently to compensate for their higher costs. An EU-wide, predictable and transparent tax framework for alternative fuels should be introduced.

7. NEGATIVE IMPACT OF SUBSIDIES FOR ZERO/LOW EMISSIONS VEHICLES

The deployment of electromobility and sustainable systems support (bonus systems) needs to be coordinated with penalties used to regulate conventional technologies. In this way, a positive "business case" can be created on the side of public budgets in the long term. Examples can already be seen in many European countries, as well as in non-EU states such as Norway, China, India and others[6].
The introduction of penalties for conventional vehicles must be carefully considered and well-coordinated with the use of

DID YOU KNOW?

Revenue from excise tax on mineral fuels currently constitutes **9%** of the Czech state budget, similar to the situation in other countries.

6 Examples of incentives for electric vehicles:
- Norway – High taxes for high-emissions cars and lower taxes for low- and zero-emissions cars
- China - Use of differentiated incentives for vehicles based on their battery characteristics
- India - Reduced purchase prices for hybrid and electric vehicles

an eco-car bonus, and targeted specifically at individual consumer segments in stages. Otherwise, there is a high risk of eco-technology negative PR, comparable to the negative public perception of the Czech state's subsidies for solar panels or biofuels.

8. EU COMPETITIVENESS

The European way of life and its high social standard are the results of its economic success amid tough global competition. EU policymakers have to keep in mind that if carbon neutrality of transport is to be viable, the cost of the transition to new powertrain solutions and its subsequent operation should be properly evaluated in the light of the massive investments needed. Important measures and stimuli in this sense might also be a carbon border tax to prevent European businesses from exporting the carbon problem beyond Europe's borders and, at the same time, protection of European businesses from competition that is not committed to decarbonization.

9. CHARGING INFRASTRUCTURE INVESTMENTS AND REALIZATION

Both the readiness of the electricity grid and the density of the charging stations network are still insufficient, bearing in mind the significant volumes of electric cars planned by the leading vehicle manufacturers. To overcome this will require close coordination of government, private sector, landowners and municipalities, which will be very challenging.

Specific attention should be paid to electric power production[7]. Coal-based production is about to be phased out in most developed countries, as well as nuclear power production in some countries.

However, replacement of the lost capacity is not sufficient to accommodate current and near-future needs, not to mention the expected surge in new demand that will come from electric vehicles[8]. The problem of the very long cycle of new capacity construction, lasting decades, is further amplified by the unresolved problem of energy storage, which is an essential prerequisite to help smooth out the rather unreliable production of energy from renewable sources.

The immense complexity of deploying charging infrastructure also raises a very important question: is this approach also applicable outside Europe, specifically in developing countries and regions?

7 Electricity generation in the world, based on the main sources in 2018: coal (38%), gas (23%), hydro (16%), nuclear (10%), wind (5%), biomass and waste (3%), photovoltaic (solar) (2%)

8 A battery electric truck using existing technology via DC charging (up to 150kW) can be charged for about 90-120km of range in 30 minutes. Higher charging standards are being developed to be able to provide an additional 600-1,000km of range within the same charging time. Trucks will also be charged in future in depots or dynamically, via overhead lines. In cities, electric trucks generate approximately one-eighth of the noise of diesel trucks. A battery truck would in a year draw as much power as 2,500 houses. Running the whole EU truck fleet (of 4.5 million vehicles) on electricity would require 324 TWh of electricity, which is around 10% of the EU's total electricity generation. For comparison, the installed output of the biggest Czech thermal energy plant, Prunéřov, is 1490 MW. If future trucks are equipped with 1 MW charging capability as envisaged, only 1490 of them could be charged at the same time using the energy from Prunéřov. Having in mind that there are approx. 50 ths. trucks on Czech roads every day, this illustrates the problem of energy production quite well.

10. CHARGING INFRASTRUCTURE STANDARDISATION

The total number of charging stations might seem sufficient "on paper", but a problem is hidden beneath the surface. The technology for public charging – especially fast (DC) charging – is developing rapidly every year. Basically, all current charging stations are incompatible with the highest incoming standards that are being introduced by car manufacturers, and the existing stations will therefore need to be upgraded or replaced in the next five years[9]. We see a high risk of EU funding being misused to pay for charging station technologies which will soon become obsolete.

11. TOTAL COST OF ELECTRIFICATION VS. OTHER ALTERNATIVES

The total cost of ownership (TCO) of an eco-car is far too high these days. Sometimes TCO is presented by industry players only as costs of ownership (CoO), where only the operational costs such as service and maintenance, fuel/electricity, insurance and others are included. TCO also include the purchase price and residual value of the vehicle.

Today, low emissions vehicles are not only more expensive but their residual value is also uncertain, especially due to anxiety about battery ageing and fast adoption of new technologies. This pushes car leasing prices higher compared to ICE cars and limits adoption on a larger scale by fleet operators. Last but not least, the TCO from society's perspective also includes a collateral effect on the environment where the holistic approach has to be applied (as stated above) and consequently through suitable taxation schemes reflected in the TCO.

12. GLOBAL SECURITY

The European Union has recently gone through a severe crisis following uncontrolled economic immigration from surrounding regions. While the flow of immigrants has recently dropped to acceptable levels, the root cause of immigration and the absence of effective countervailing measures persists. EU officials as well as NATO leaders should work with various scenarios assuming the possible future economic collapse of Middle Eastern and African countries that are heavily dependent on crude oil production in the event that oil prices and volumes decline substantially due to the decarbonization of Western economies.

Such momentum may cause a new wave of social unrest, terrorism, local or regional wars and finally a new massive wave of migration to Europe. This, coupled with the impacts of climate change, may become a barely manageable problem.

9 Examples:
- An increase in charging speed using DC from standard 50kW to 150kW or even 250-350kW
- The adoption of 800V technology in the premium and commercial vehicle segment (instead of the current 400V)
- Introduction of new communication and charging standards such as plug-and-charge, wireless charging and DC charging energy distribution management
- Legislative changes and requirements affecting charging point operators and eMobility service providers, mostly represented by the German "Eichrechtskonformität" which might also be introduced soon in other European countries and perhaps eventually as a European approach.

EUROWAG ON SUSTAINABLE MOBILITY

As an important player within the European road mobility ecosystem, and bearing in mind that vehicles are believed to be responsible for approximately 12% of total EU-wide emissions of carbon dioxide, we at EUROWAG feel a natural responsibility to contribute actively to the transformation of road mobility and dedicate substantial resources to various projects and initiatives. Furthermore, we are ready to share our insights and expertise, which we have been acquiring in the field over the last 20 years.

Starting as a fuel, toll, payment and telematics provider, EUROWAG is shifting into the role of integrated mobility solutions provider. We are in principle technology-agnostic, which makes us well positioned to evaluate clean mobility without dangerous ideological and political biases.

EUROWAG's values commit us to consciously helping to create a balanced set of values for the benefit of society in the field of sustainable and environmentally friendly solutions within mobility. Since their establishment in early 2019, our Electromobility and Alternative Fuels Departments have been assigned to define and execute the roll-out of specific products and services for vehicles with alternative powertrains – such as electric and hybrid cars, vehicles powered by gas (CNG, LNG), as well as vehicles utilising fuel cell technology.

FOR MORE INFORMATION PLEASE CONTACT:

Petr Füzék - electromobility
petr.fuzek@eurowag.com

Anne Schwier – alternative fuels
anne.schwier@eurowag.com

ATTACHMENT
EMOBILITY SOLUTIONS

SOLUTIONS
FOR ELECTRIC VEHICLES OPERATORS

EUROWAG's product portfolio addresses the three main fears and inconveniences for e-car early adopters as well as established electric car operators:

1) **Electric vehicle range anxiety**
Until now, most e-cars have had very limited operating range, since battery capacity was 20-40 kWh – with the single exception of Tesla, which is reflected in its higher price. The good news is that the next generation of vehicles coming in the years 2020-2025 will offer further range thanks to increased battery capacity of 40-80 kWh in vehicles with a price tag of €25,000 to €60,000.

Another reason for range anxiety is the hazy predictability of e-cars' (electricity) consumption compared to ICE cars. Compared to a regular ICE vehicle, where consumption varies between 5 and 5.5 litres/100km, a similar vehicle with an electric motor has a consumption of between 14 and 22 kWh/100km. This gives the driver significantly higher responsibility for the final range of the vehicle. What also needs to be reflected is the new EU methodology for homologation of consumption (since 2017). The old NEDC (New European Driving Cycle) was replaced by the WLTP (World Harmonised Light-duty vehicle

Figure 1: NEDC

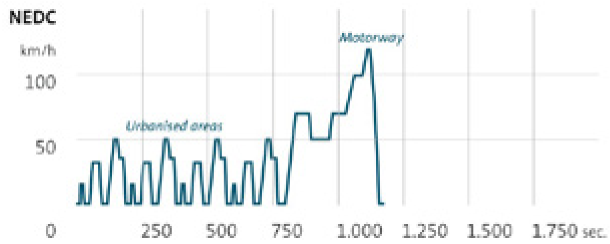
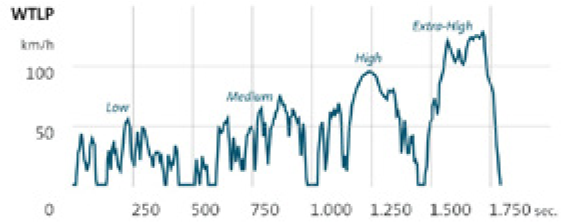


Figure 2: WLTP



Source: https://www.volkswagen.cz/technologie/wltp

Test Procedure) and, as a result, the estimated range of cars is far closer to reality in terms of e-cars' daily range. Moreover, there is better data of predictive value, since many car manufacturers communicate the ranges for different driving modes (urban vs. highway etc.).

We at EUROWAG have access to every conceivable telematic data from different types of vehicles. That puts us in a unique position in the market and enables us to work on analysing and evaluating all the relevant data. We are developing smart online tools to help translate those data into a transparent form that can be easily understood by users – and which they can use on a daily basis. We calculate consumption depending on driving style, weather conditions, route type, elevation, type of charging station, and many more variables.

2) **Electric vehicle charging anxiety**

The situation on the market is often described as a chicken-or-egg problem. Does the scarcity of vehicles explain the relative absence of infrastructure, or is it the other way around? But the relevance of the number of points available for public charging may be overstated. About 85% of charging operations happen at home or at work. The rest take place either at normal or fast semi-/public charging stations.

Figure 3: DC charge points in Europe

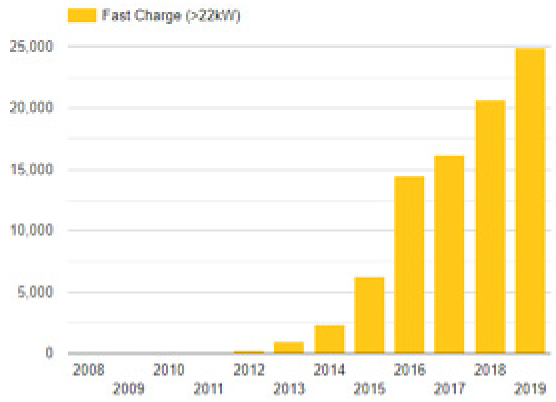
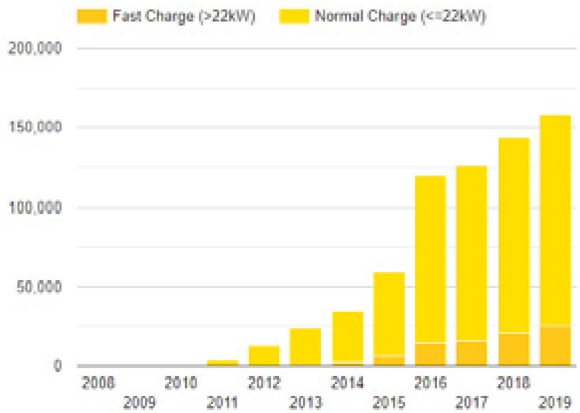


Figure 4: All charge points in Europe



Source: https://www.eafo.eu/countries/european-union/23640/infrastructure/electricity

Normal charging stations are considered AC (alternating current) stations which are able to charge a vehicle with the following performance (depending on the type of car and the hardware used by the station):

	AC (alternating current) charging station				
Power supply (single-phase/ three-phase)	1F		3F		
[A]	16	32	16	32	64
Power output [kW]	3,6	7,2	11	22	43
Equivalent of (km/1 min. of charging)	0,3	0,6	1	2	4

Fast charging stations' performance is again influenced by the specifics of the vehicle and the charging station:

	DC (direct current) charging station							
Voltage [V]	400 V							
Power output [kW]	22	50	100	125	150	250		
Voltage [V]					800 V			
Power output [kW]					150	250	350	500
Equivalent of (km/1 min. of charging)	2	5	10	12	15	25	35	50

We can see a significant difference in the market when it comes to the number of AC/DC charging points, where about one in six of all stations are fast – and among those, only very few are faster than 50 kW. This does not correlate with the vehicle charging performance development and the customer experience described by car manufacturers. Car manufacturers assure users that an electric car can be charged in, for example, "20 minutes" or "40 minutes" – which refers to DC charging – or in 1.5 to 4 hours when referring to AC charging. However, to be able to fulfil these numbers, a driver would face serious problems finding the right station and also in re-creating the ideal conditions for charging the car, such as charging it from 0 to 80%. Here is an illustrative example:

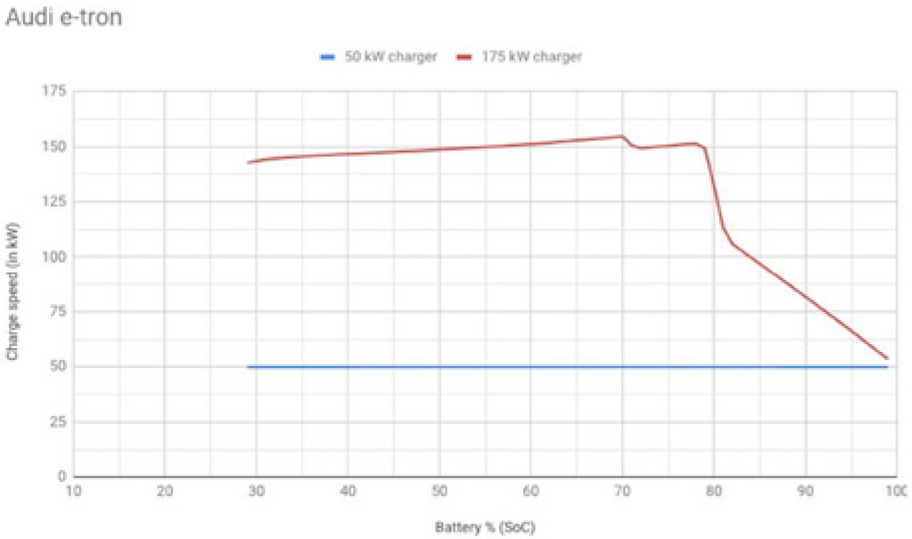


Figure 5 Charging efficiency drop in fast charging operation

Source: https://insideevs.com/news/342441/fast-charging-comparison-audi-e-tron-mercedes-eqc-jaguar-i-pace/

As mentioned above, approximately 15% of all charging operations happen in public in circumstances equivalent to fuel stations – and mostly such usage is classified as "emergency" charging for longer distance travel or as "opportunity" charging combined with privileged parking locations or with shopping, etc. Public charging is usually significantly more expensive than charging at home and requires registration and/or the right mobile app solution to be able to authorise and pay. To make this even more challenging, it varies from not only country to country, but also between each charging station operator and charging service provider.

We can see that the charging experience on the road is not quite the same as the one drivers are familiar with from their ICE vehicles, and requires additional trip planning, according to the specifics of the vehicle and the availability of stations nearby or en route. At EUROWAG we aim to provide our customers and drivers with convenient and easy-to-use tools that enable them to plan, search and calculate; we then just navigate them to suitable charging locations according to the driver's preferences and the specifics of their vehicle and nearby stations.

3) Economic aspects of purchasing electric vehicles

There is, as yet, no ambition to replace all the vehicles on the road with electric cars within a medium-term time frame. Even if every vehicle sold from next year were to be electric, it would still take as many as 30 years before the last ICE vehicle was replaced from the existing fleet. The popularity of electric cars in recent years has been a reaction not only to local regulation, but electric vehicles have clearly shown great potential to become an important and inherent part of fleets and also serve the needs of some groups of end users rather well.

To be able to determine the right timing and scale for the integration of these cars in the company fleets we take into consideration all the relevant aspects, and provide our customers with an advice on choosing the right vehicles for an operations in the specific conditions for their business activities.

For more information about our eMobility services
please contact us at **emobility@eurowag.com**

EUROWAG

W.A.G. payment solutions, a.s.
Registered seat: Na Vítězné pláni 1719/4, 140 00 Praha 4, Czech Republic | ID No. 26415623
Reg. in the Commercial Register maintained by the Municipal Court in Prague, File No. B 6882