GERMANY

TRANSPORT

Twists and turns on the road to the Verkehrswende, "green mobility"

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GERMANY

Twists and turns on the road to the Verkehrswende, "green mobility"

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Compared to the progress made in the Energy Transition (*Energiewende*), greenhouse gas (GHG) emissions from transport have been on the rise since 2010 making the transition to green mobility (*Verkehrswende*) uncertain. While there are some encouraging signs, such as investments in alternative forms of motorisation or cities' shift to low-impact transport, a clear direction towards the decarbonation of the transport sector is still missing.

Key takeaways

German transport-related emissions currently amount to 165.1 million tonnes of CO_2, slightly above their 1990 level. According to the Climate Action Plan 2050, released in 2016, these emissions should plummet by more than 40% between 2018 and 2030;

In 2018, 3.4 million cars were sold in Germany. Their average emissions were among the highest in the EU (129.9gCO_2/km compared to 120.6gCO_2/km on average). EU regulation requires vehicle manufacturers to achieve on average an emission level of 95 gCO_2/km in 2021;

The competitive edge of the German automotive industry heavily relies on the traditional internal combustion engine and there is no consensus in the sector on an alternative. Despite numerous incentives, the automotive industry continues to choose its technologies largely independently of the solutions favoured by policy makers;

Logistics, another key sector for the German economy, is experimenting to find low-carbon solutions for transport and storage. Although rail freight has been on the rise, long-haul trucking remains a crucial issue as it represents 72% of freight transport;

Cities play an important role as laboratories to experiment on regulation (e.g.: urban tolls, diesel bans, etc.) combining organisational and technological innovation. The modal share of public and low-impact transport has been increasing once again in large cities for the past ten years.

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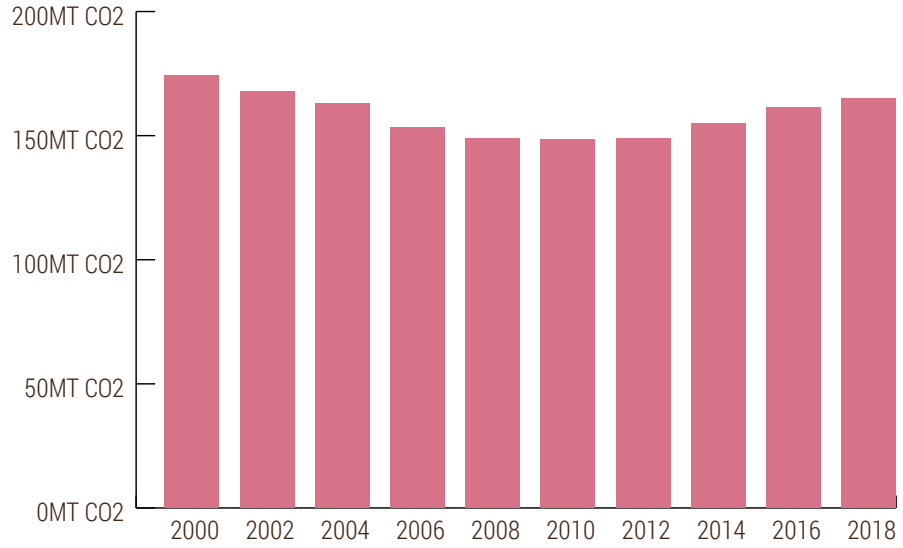
1 – Transport: the black sheep of German GHG emissionss

GHG emissions in the transport sector in Germany amounted to 165 mil (Enerdata, 2019). Following a peak at 178.4 $MtCO_2e$ in 1999, emissions in the transport sector declined in the early 2000s, followed by a period of stability in the wake of the 2008 economic and financial crisis.

Nevertheless, since 2012, there has been a steady increase of 1.8% per year in the transport sector's CO_2 emissions (fig. 1) which is partly due to the **national carbon footprint: the transport sector represents 21.3% of national emissions in 2018 but only 18.3% in 2012.** This is in contrast to other sectors, notably the electricity sector.

FIGURE 1

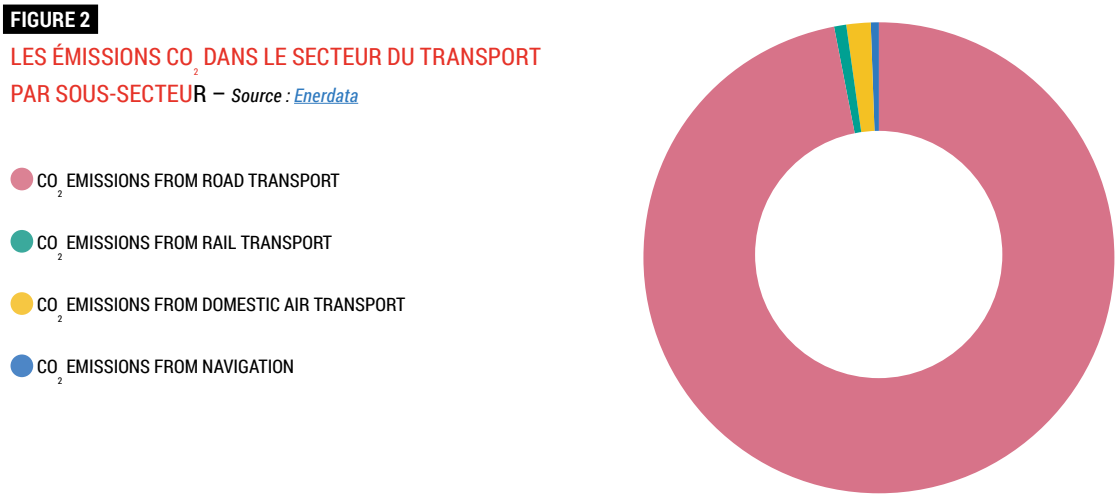
TRANSPORT CO_2 EMISSIONS 1999-2018 – *Source : Enerdata*



Road transport is by far the largest contributor to transport-related CO_2 emissions. Other sectors, such as domestic air, rail or maritime transport's shares are almost insignificant (fig. 2). In 2017, Germany listed 6.5 $MtCO_2e$ emissions for international navigation and 29.1 $MtCO_2e$ for international aviation (EEA, 2018).

FIGURE 2

LES ÉMISSIONS CO_2 DANS LE SECTEUR DU TRANSPORT PAR SOUS-SECTEUR – *Source : Enerdata*



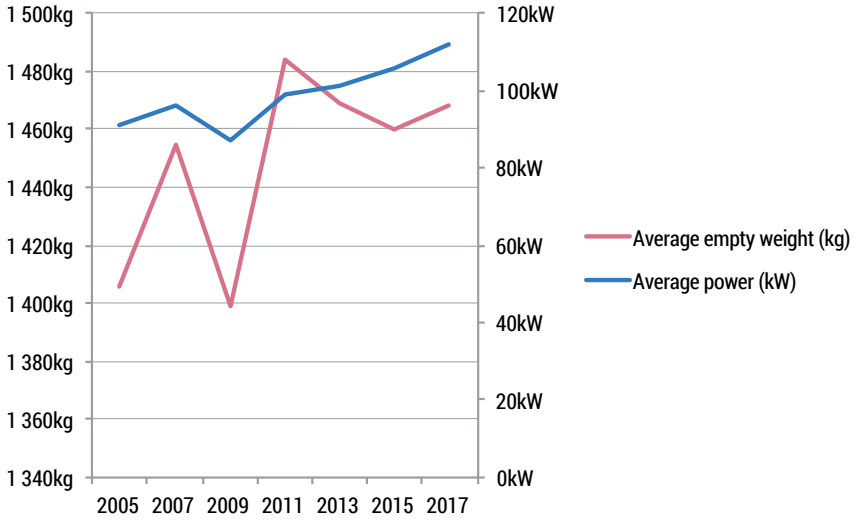
FOR A BETTER UNDERSTANDING

THE GERMAN VEHICLE FLEET AND ITS EVOLUTIONS

45.8 million personal cars are currently in service in Germany, to which must be added 3.4 million light commercial vehicles and 80,000 heavy vehicles. With over 550 cars per thousand inhabitants, the equipment rate in Germany is one of the highest of Europe. Approximately 3.4 million new private vehicles are sold every year, a steady number since 2000. Compared to the rest of the EU, cars sold on German soil are heavier, on average (1,468 kg empty against 1,395) and more powerful (112 kW against 97) (fig. 3). The share of four-wheel drive vehicles is also higher (20% compared to 14) and constantly increasing. The share of diesel has dropped sharply from 46% in 2016 to less than 39% in 2017. This decline and the growth of heavy vehicles (SUVs, crossovers, etc.) make the vehicle fleet more GHG-emitting.

FIGURE 3

EVOLUTION OF THE AVERAGE EMPTY WEIGHT AND AVERAGE POWER OF VEHICLES SOLD IN GERMANY 2005-2017 – *Source :* ICCT, 2018



Source : ICCT, 2018

BOX 1

The Climate Action Plan 2050, which replaces the country's Climate Action Programme 2020, is inspired by the Paris Agreement on Climate Change as it aims to make Germany climate neutral by 2050 (BMUB, 2016). In line with the EU's climate goal of reducing greenhouse gases by 80 to 95% by 2050, the German government set a target to reduce greenhouse gas emissions by at least 55% in 2030 compared to 1990 and subsequently achieve a target of at least 70% reduction by 2040 (Gouvernement Fédéral de l'Allemagne, 2016).

FIGURE 4

EMISSION REDUCTION TARGETS BY SECTOR – *Source :* Federal Government of Germany, 2016

Area of action	1990 *(in million tonnes of CO_2 equivalent)*	2014 *(in million tonnes of CO_2 equivalent)*	2030 *(in million tonnes of CO_2 equivalent)*	2030 (reduction in % compared with 1990)
Energy sector	466	358	175 – 183	62 – 61 %
Buildings	209	119	70 – 72	67 – 66 %
Transport	163	160	95 – 98	42 – 40 %
Industry	283	181	140 – 143	51 – 49 %
Agriculture	88	72	58 – 61	34 – 31 %
Subtotal	1209	890	538 – 557	56 – 54 %
Other	39	12	5	87%
Total	**1248**	**902**	**543 – 562**	**56 – 55 %**

According to the Climate Action Plan 2050, transport-related emissions should be reduced by at least 40% in 2030 compared to 1990. This objective is equivalent to a 42.3% drop of transport sector emissions between 2018 and 2030, a highly ambitious target (fig. 3). The plan also envisions a virtually carbon-free transport system by 2050.

2 – Insufficient National policies for reaching European targets

• EUROPEAN EMISSION NORMS AND THE WEIGHT OF INDUSTRY • With average CO_2 emissions of 143 gCO_2/km, German manufacturers did not reach the new vehicle emission limits imposed by European regulations by 2015 **(130 gCO_2/km on average).** In 2018, average emissions per vehicle were 129.9 gCO_2/km in Germany (against a European average of 120.6 gCO_2/km), the highest in the EU after Estonia and Luxembourg and far from 105.5 gCO_2/km in the Netherlands, the most efficient country. Germany should therefore also miss the 2021 target of 95 gCO_2/km. In 2018, new light commercial vehicle sold in Germany were the most polluting in Europe with 173.4 gCO_2/km, compared to 158.1 gCO_2/km on average and 133.7 gCO_2/km in Portugal (EEA, 2019).

FOR A BETTER UNDERSTANDING

EUROPEAN UNION EMISSIONS REGULATION AND THE WEIGHT OF THE INDUSTRY

Average 2015 emission targets per vehicle (130 gCO_2/km) was initially planned for 2012 but pushed back after French and German pressure in 2008. Germany also has a deadline for the 2021 target (96 gCO_2/km) initially set for 2020.

These limits apply to the average emissions of vehicles sold by manufacturers. It is therefore possible to market vehicles exceeding the thresholds provided that their sale is compensated by the sale of more efficient vehicles. Manufacturers can also pool their fleets, so those who do not comply with the threshold can avoid penalties through a partnership with a manufacturer whose fleet emits on average less than the limit.

These developments are due to pressure from car manufacturers, particularly German car manufacturers, who also intervened in the negotiations to set new emission limits by 2030,

opposing a reduction of more than 20%. This position was partially taken up by the German government, which defended a 30% reduction in emissions against countries such as Denmark, the Netherlands and France, which pleaded for 40%. A target of 37.5% was finally adopted in January 2019. The German Automobile Manufacturers' Association (VDA) has denounced a decision that "demands too much and encourages too little", stating that "no-one knows today how this objective can be achieved in time". The recovery of these positions is facilitated by the porosity between industry and German political circles. Matthias Wissmann, President of VDA, was Minister of Transport between 1993 and 1998, for example. In contrast, Angela Merkel's campaign manager in 2017 was previously vice-president in charge of institutional relations at General Motors.

Manufacturers' attempts to limit regulatory constraints sometimes go beyond what is legal. BMW, Daimler and the three Volkswagen group brands, VW, Audi and Porsche, are all accused of having agreed between 2006 and 2014 to delay the development and deployment of technologies to reduce nitrogen oxide and fine particulate emissions. Upon Daimler's denunciation, the European Commission has opened an investigation that could lead to fines amounting to 10% of their global turnover.

Source : T & E, 2018 ; DW, 05/09/2017 ; DW, 17/12/2018

BOX 2

Emission labelling based on fuel consumption as well as CO_2 emissions for new automobiles were introduced in Germany in 2008. Energy efficiency is evaluated in relation to vehicle weight. The efficiency ranking, ranging from A+ (best) to G (worst), is defined in function of the deviation of a vehicle model compared to the reference value for the respective vehicle rank (fig. 5). To be classified as A, a car with an unladen weight of less than 1,000 kg must emit less than 171.5 g CO_2/km. An assessment by the Ministry of the Environment (UBA, 2012) suggère que cette mesure n'a qu'un effet limité sur la réduction des émissions.

FIGURE 5

CO_2 EFFICIENCY RANKING – *Source : Pkw-Energieverbrauchskennzeichnung*

CO_2 efficiency rank	Deviation from the reference value
A +	≤ – 37 %
A	-36,99 % to – 28 %
B	-27,99 % to – 19 %
C	-18,99 % to – 10 %
D	-9,99 % to – 1 %
E	-0,99 % to +8 %
F	+8,01 % to +17 %
G	> +17,01 %

• A COUNTER-PRODUCTIVE TAX SYSTEM • Since the 2000s, the German government has introduced several measures to encourage motorists to adopt more fuel-efficient behaviours and vehicles. According to Forum Ökologisch-Soziale Marktwirtschafft (2018), an NGO that promotes environmental tax policies, Germany's vehicle tax system remains the least efficient in Western Europe.

Car Tax *" Kfz-Steuer"*	– Annual tax on car owners – Calculated on the basis of CO_2 emissions from vehicles (ITF, 2010). The amount of the carbon share of this tax is €2 per gram above 95gCO_2e/100km. – Zero emission vehicles are exempted for 10 years and then taxed depending on their weight (Lah, 2016).
Energy Tax "Energiesteuer"	– Tax applied to fuels: 65.45 cents/L for gasoline; 47.04 cents/L for diesel; 18 cents/kg CNG or LNG (BMF 2012). – The 1999 ecological tax reform led to an increase in taxes on petrol and diesel of 3.07 cents/L/year for 5 years. – 90% of the revenue from this increase was allocated to a reduction in taxes on labour (Cour des Comptes, 2011). Despite opposition, this reform has survived all governments thanks to the social contract that drives German political process (Lah, 2017a).
Motorway tolls "LKW-Maut"	– Since January 2009, road tolls for heavy goods vehicles have been calculated on the basis of vehicle emissions, weight and number of axles. E.g.: For heavy three-axle vehicle, the load varies from 17.3 to 24.7 cents per kilometre, depending on the emission class. – The €4.48 billion in revenue in 2010 was partly pointed towards tax reductions on light vehicles (€100 million) and the promotion of low-emission vehicles, driver training, and environmental programmes (€450 million). – The introduction LKW-Maut helped to reduce empty journeys from 1% to 2% and to stop the growth of medium-distance road transport but failed to meet its objectives for changing the modal share (Institute Fraunhofer ISI, 2017). Impacts on economic growth, employment and consumer prices have been negligible.

The treatment of corporate fleets is another limitation of German carbon taxation. The purchase and operating costs of corporate fleets are tax deductible and the vehicle user pays only a very low tax. This tax exemption largely calls into question the effectiveness of carbon taxation on vehicles: 65% of the 3.4 million new vehicles registered in Germany each year belong to company fleets, which are composed of vehicles with higher than average power and are used more than passenger cars (24,672 km per year compared to 12,828 km per year for passenger cars) (Metzler, 2019). The abolition of this tax exemption or its imposition as a condition of issue has been proposed for more than 10 years (Görres and Meyer, 2008).

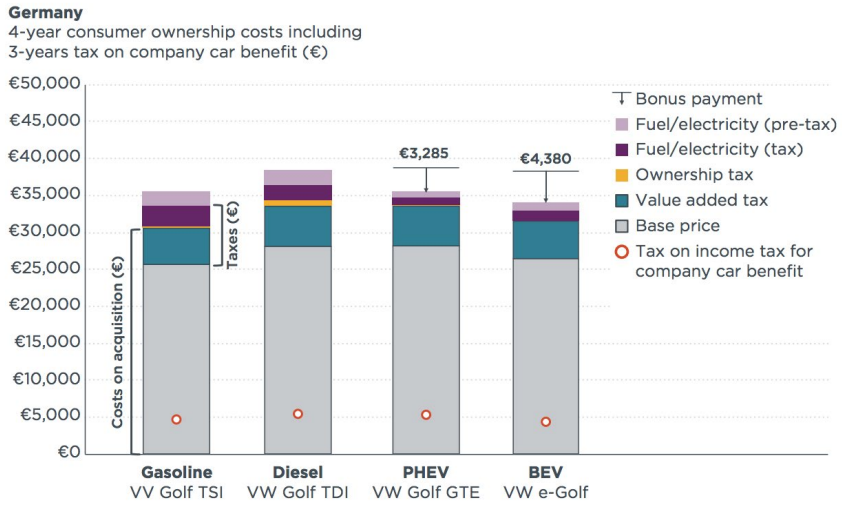
Other tax rules in force in Germany have counter-productive effects on road transport emissions. For example, it is possible to deduct commuting from income tax. Until 2001, only car travel was eligible for this deduction, encouraging urban sprawl by subsidising long distances between home and work (UBA, 2010). Although a fixed kilometric rate applicable to all modes of transport is now available, this deduction is still considered to offer unfair advantages for commuting by car, because its limit can be increased if a private car is used (UBA, 2010). Tax incentives to promote home ownership and construction are also considered to contribute to urban sprawl and encourage car travel (Hirte et Tscharaktschiew, 2012).

• ALTERNATIVE FUELS DEVELOPMENT • Taxes combined with a marginal difference in purchase

and maintenance costs mean that electric vehicles do not provide significant consumer benefits over conventional vehicles (ICCT, 2018) (Fig. 6). The National Electromobility Development Plan sets a target of 1 million electric vehicles on the road by 2020 with investments in the development and marketing of electric vehicles and the creation of pilot regions for electric mobility with test sites and appropriate infrastructure. However, the high level of electricity levies is up to 56, which is higher than the rate of taxes on diesel. In 2018, 36,062 new electric vehicles were registered in Germany (KBA, 2019), bringing the total number in the country to around 170,000, far from the 2020 target (Reuters, 19/09/2018). In addition, a study by the Wuppertal Institute on pilot region for electromobility indicates that the net climate balance of electric vehicles may only become positive after 2030 given the still high carbon footprint of the German energy mix (Schallaböck et al. 2012).

FIGURE 6

OMPETITIVE EDGE OF VEHICLES SOLD IN GERMANY PER FUEL AND TAX – *Source : ICCT, 2018a.*



FOR A BETTER UNDERSTANDING

FEDERATED GOVERNMENTS JOIN FORCES TO PROMOTE ELECTRIC AND HYBRID VEHICLES

Since July 2016, individuals, companies, foundations and organisation can benefit from a grant for the purchase of an all-electric vehicle (BEV), a fuel cell vehicle (FCEV) or a plug-in hybrid vehicle (PHEV) which will end when the €6 million government credit for its share is exhausted or, at the latest, at the end of 2019. The federal government subsidy (€2,000 for BEVs and FCEVs emitting 0gCO_2/km and €1,500 for PHEVs emitting less than 50gCO_2/km) is paid on condition that the manufacturer grants the buyer an at least equal reduction on the catalogue price of the model. Thus, both manufacturers and the governments pay €2,000 or €1,500 within the limit of €3,285 for PHEVs, including VAT. Vehicles eligible for a grant may not exceed a net list price of €60,000.

Source : BAFA, 2018

ENCADRÉ 3

Germany has 421,000 vehicles powered by "Autogas" liquefied petroleum gas, most of which are converted petrol cars. This represents about 1% of the vehicles on the road, a much higher fleet than any other alternative engine. However, new vehicle sale and conversions are not enough to compensate for the scrapping of old vehicles (WLPGA, 2018). According to the Federal Environment Agency, gas-powered engines have very limited potential to reduce GHG emissions due to methane leakage during extraction and transport. This being said, Autogas is still support by the State

with a reduce tax rate, extended in 2017 until the end of 2022 and investments in infrastructure. In 2018, the German government decided, to develop liquefied natural gas (LNG) import terminals and infrastructure with transfer, storage and redistribution facilities for the use of natural gas as a marine and road fuel (O'Donnell, 2018).

Finally, biofuels have long been considered an essential link in Germany's low-emission transport policy and have been supported by tax breaks and a 10% biofuel share in petrol and 7% in diesel. These measures have helped to make Germany the leading biodiesel producer in the European Union. The climate benefit of biofuels remains questionable and their public image has deteriorated (Anderson-Teixeira, Snyder et Delucia, 2011). **In 2009, the government published a regulation** (Biokraftstoff-Nachhaltigkeitsverordnung) **stipulating that biofuels can only be considered sustainable if they lead to an emission reduction of at least 35% over their entire life cycle compared to fossil fuels. Biofuels that do not meet these standards are not eligible for tax reductions and do not benefit from blending quotas.** Tax exemptions on biodiesel have been gradually reduced, leading to an increase in taxes to 45.03 cents/L, compared to only 18.6 cents prior to 2011. As a result, biodiesel production in Germany decreased slightly to 3.2 million tonnes in 2018, mainly from rapeseed (58%) and used cooking oil (27%) (Biofuels International, 2019).

3 – Business and industry: a disproportionate weight of automotive and logistics

• NO TECHNOLOGICAL BREAKTHROUGH • Germany, the third greatest car producer in the world, is home to some of the biggest and most competitive car manufacturers in the world. In 2017, the industry produced over 5.6 million vehicles (OICA, 2019), and reached a record turn-over of €422.8 billion and makers of motor vehicles and vehicle parts employed 820,000 workers (VDA). This large auto industry with its technical know-how and investment capacity can be an asset for the mobility transition but it may also be a drawback as those companies have a lot to lose from the decline of traditional mobility and its reliance on internal combustion engines.

Historically, German car manufacturers have invested substantially into efficiency improvements of the internal combustion engine. There was also an active exchange with scientists, and civil society on the future of the industry (Levy, 2002). **The auto industry was driven towards efficiency by the CO_2 regulations for the vehicle fleet from the European Union. However, technology choices among car makers differed. Disruption is not created by policy pressure only but also by the simultaneous appearance of internal and external 'change agents'. As a result, manufacturers exposed to the same environment can respond with different solutions**. For instance, Volkswagen specialised in smaller more efficient combustion engines while BMW, very early, chose to focus on alternative fuel vehicles (Mazur, 2015).

EXPERIENCE FEEDBACK

VOLKSWAGEN (VW) STRATEGY TO REDUCE GHG EMISSIONS

With an annual production of 10 million vehicles and a turnover equivalent to Portugal's GDP, Volkswagen is currently the world's leading car manufacturer. Although the company conducted tests on electric vehicles, hybrids and fuels cells in the 1990s, its efforts focused more on improving the efficiency of internal combustion engines.

In 19998, VW introduced its Lupo 3L with a fuel consumption of 3 L/100 km and in 2002 the company announced a 1 L/100 km vehicle – a project that was quickly cancelled due to lack of

demand. In response to the success of Toyota's Prius hybrid car in the late 2000s, VW partnered with Daimler and General Motors to create low-emission engines under the BlueTEC brand. This led to the development of smaller engines such as the 1.4-litre turbocharged TSI (awarded as "International Engine of the Year" in 2009 and 2010 and winner in its category 7 consecutive years). The 1L vehicle project was relaunched in 2007, resulting in several prototypes, the most recent dating from 2013 and called XL1 Super Efficient.

Despite increasingly stringent regulatory constraints, VW has not challenged the internal combustion engine and has specialised in a range of vehicles smaller than other manufacturers hoping to follow the emission path imposed by European regulations without a technological breakthrough such as the electrification of its range. On the other hand, Porsche which is part of the VW group, started working on electric propulsion in 2007. The company has developed hybrid vehicle sin response to its customers' demand for "green" SUVs by collaborating with Sanyo in Li-ion batteries.

VW finally started developing electric vehicle concepts in the 2010s with an electric version of the Golf in 2015 and the ID.3 in 2019 (an all-electric compact vehicle with a range of up to 550 km to be produced in large series from 2020). Production will be carried out at the Zwickau plan in Eastern Germany. The conversion of this plant from traditional vehicle production to 330,000 electric cars per year is a world first and will be completed in 2021 after an investment of 1.2 billion euros.

Source : Mazur, 2015 ; Bloomberg, 06/09/2019

BOX 4

In 1995, 13 large industry associations entered a voluntary agreement to reduce their greenhouse gases emissions by 20% in 2005 compared to 1990. The auto industry agreed to reduce CO_2 emissions from new cars by 25%. In return, the government stated that it would refrain from using regulatory or fiscal tools to reduce emissions and pushed similar measures at the European level (Levy, 2002). This governance was challenged when it emerged that the German manufacturer manipulated pollution tests to make their vehicles' emissions (especially nitrogen oxides emissions from diesel engines) appear lower than they were.

Since 2015, the "Dieselgate" boosted public interest for cleaner cars and led regulators to tighten their standards, this initiated transformations in the automotive industry towards the integration of sustainability into the product development process (Held, 2018). It also raised public awareness of air pollution and the economic challenges facing manufacturers: at the 2019 International Motor Show, between 15,000 and 25,000 demonstrators, who opposed cars and the pollution they cause, marched on foot or by bicycle denouncing the importance given to cars in cities, the expanding SUV market as well as public health risks (Le Monde, 2019). In 2019, there was a drop in attendance with only 560,000 visitors compared to 930,000 in 2015. On top of that, some key manufacturers were not present, such as Toyota, Renault and Nissan (AutoPlus, 2019).

While car manufacturers are mainly held responsible for vehicle emissions, suppliers increasingly play a key role in efforts to cut emissions. Suppliers generate about 70% of added value (Damert, 2017). Some progress was made on that side, for example energy management had a positive effect on the adoption of low-carbon production and logistics practices and through this indirectly on carbon and economic performance by car parts manufacturers (Böttcher, 2016). **An analysis of firm position shows that the more a supplier is upstream in the industry value chain, the more it is being proactive on emissions reduction. Conversely, car brands will be more cautious of it, highlighting the negative impacts of emissions regulation on their activities** (Klebaner, 2016).

• LOGISTICS • Le chiffre d'affaires du secteur du transport et du stockage est d'environ 350 milliards d'euros par an, ce qui en fait l'un des plus importants secteurs économiques en Allemagne, avec des opérateurs de premier plan tels que Deutsche Post DHL, Deutsche Bahn, Kuehne + Nagel ou Hellmann. **Ces dernières années, ce secteur a connu une croissance plus rapide que les activités industrielles, soutenue par l'essor de la construction, le développement des livraisons liées au commerce électronique, de l'importance croissante des services à forte valeur ajoutée et d'effets de prix** (Deutsche Bank, 2019). Entre 1990 et 2014, les volumes totaux de trafic de fret – acheminés par route, par chemin de fer, par voie navigable et par air – ont plus que doublé pour atteindre environ 650 milliards de tonnes-kilomètres (BVDI). La réduction des émissions de CO_2 représente un énorme défi réglementaire et technologique pour le secteur de la logistique en Allemagne.

FOR A BETTER UNDERSTANDING

VULNERABILITY OF THE RHINE WATERWAY TO DROUGHTS

Transport contributes to GHG emissions but is also exposed to the consequences of climate change. The drought in 2018 illustrated this vulnerability when the low water level of the Rhine river led to a drastic limitation of traffic in its 1,200 km of waterways. In Cologne, usually of around 3 m, the water level dropped to 70 cm in places, the lowest in nearly a century. A bottleneck has formed in Kaub near Frankfurt, where the level has dropped to 20 cm. The draught of the barges is 90 to 120 cm when empty: a large fully loaded barge needs a depth of 3 to 3.5 m to sail safely.

This situation has led to a tenfold increase in the inland waterway freight tariff and the saturation of alternative transport (road and rail). The bottleneck has had a serious impact on the Rhine industry: Thyssenkrupp had to stagger its deliveries to Volkswagen; BASF estimated that this situation cost it €250 million, and was obliged to declare a case of force majeure for its nylon production based in Ludwigshafen; some power plants such as RWE power plant in Hamm had their coal supplies disrupted and Germany and Switzerland withdrew from their strategic reserves of oil products to deal with supply shortages.
This particularly severe low water level is linked to both reduced precipitation and earlier melting of alpine glaciers. The situation seems likely to be repeated: traffic upstream of Kaub was reduced again in July 2019.

Source : FT, 25/10/2018 ; JOC, 26/10/2018 ; Insurance Journal, 24/07/2019

BOX 5

Coalitions and platforms such as "Low Carbon Logistics" or "German Partnership for sustainable mobility" were implemented to tackle these issues, often in collaboration with local authorities and research centres. Various solutions are being investigated such as low-carbon vehicles, cargo bicycles for urban logistics, or "electric highways" for long-distance lorries:

• As car manufacturers were not interested in electric urban delivery vehicles, the Deutsche Post DHL group therefore chose to buy a specialised start-up to produce its own electric delivery vans. The vehicle is a spectacular success that has led the postal service to market it, and to increase production to 20,000 vehicles per year (Clean Energy Wire, 2018).

• With limited battery charge for long distance travels, motorways with overhead power lines akin to those used by inner city trams and railways are being considered. A 5-kilometre pilot project is set to be open in 2019 in the state of Hess. Engineering giant Siemens, the Technical University of Darmstadt, and five haulage companies are involved in this project. According to the German Industries Federation, achieving zero emissions would require 8,000 kilometres of highways to be equipped with this technology (BDI, 2018).

EXPERIENCE FEEDBACK

DEUTSCHE BAHN INITIATIVES TO PROVIDE LOW-CARBON TRANSPORTATION AND LOGISTICS SERVICES

Deutsche Bahn (DB) is the historical operator of Germany's railways and one of the largest transport companies in the world.
DB aims to reduce its CO_2 emissions from rail, road, air and ocean transportation by 30% in 2020 compared to 2006 levels, this means doubling the previous target (-20% in 2020 compared to 2005) which was reached earlier than planned in 2015. DB was part of the CDP's A-list in 2017 and 2018. By 2050, DB has set a goal of achieving rail transport that is completely CO_2-free.
In addition, DB wants to raise the share of renewable energy to 45% in 2020 and 80% in 2030. All long-distance trains operated by the company in Germany and to European Cities are already powered by renewable electricity, making DB the largest green electricity consumer in Germany.

DB Schenker, DB's logistic division, has set out to become the leading provider of green transportation and logistics services. DB Schenker offers solutions to avoid, reduce or compensate CO_2 emissions from supply chains under the Eco Solutions label. Among other initiatives, DB Schenker Logistics and Maersk Line have signed a six-year strategic 'Carbon Reduction Agreement' to reduce CO_2 emissions by 20% per container moved for DB Schenker Logistics between 2014 to 2020. In May 2019, DB Schenker opened its first low-carbon city distribution centre in Oslo. According to the company, this centrally located new terminal will reduce CO_2 emissions of city goods distribution by 80%, by using electric cars and e-bikes.

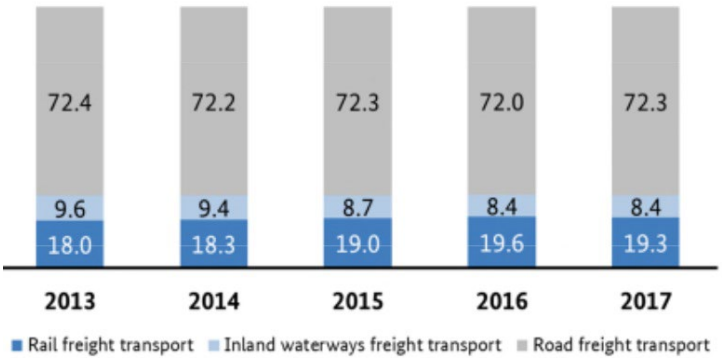
Source : DB

BOX 6

• MODAL SHIFT FROM ROAD TRANSPORT TO STATIONARY TRANSPORT • Since 2013, the share of rail in freight transport has increased by 1.3 points. However, this shift does not come from the road but from the waterways (fig. 7). The modal split of passenger transport over the same period remained stable at 83.6% for road transport.

FIGURE 7

FREIGHT TRANSPORT BY MODE OF TRANSPORT 2013-2017. – *Source : Destatis, données du Market Monitoring de la Bundesnetzagentur.*



The *Länd* of Hesse, in the centre of Germany, hopes to expand freight rail in its terminal (currently 18 million tonnes per year) and participate in reducing road freight at both regional and national levels. For this to be done, the *Länd* presented an intermodal regional cluster to the main businesses in the transport sector such as Kombiverkeher, House of Logistics and Mobility (HOLM), and Hessen Trade & Invest GmbH (Railfreight, 2019).

The Association of German Transport companies defends the introduction of tax system based on the Swiss model including a carbon tax high enough to encourage using rail. The German

Federation of Regional Train Passenger Authorities (BAG-SPNV) called for continued electrification of the rail network, estimating that 36% of the train-km (1 train running over 1 km) carried out by its members are still due to diesel traction. Currently, only 60% of the rails in Germany are electric (Railjournal, 2019).

The German governments seems to be taking the issue of the modal shift very seriously by agreeing with Deutsch Bahn on an investment plan of €86 billion in rail infrastructure over the period 2020-2029, 60% more than over the 2015-2019 period. This plan has yet to be approved by Parliament (Railway, 2019). It should also be noted that the capital gains tax has been reduced from 19% to 7% on journeys less than 50 km. DB estimates that a similar reduction on long journeys could increase the number of overall trips by around 5 million per year and help it meet one of the objectives of its Strong Rail growth plan by reaching 260 million passengers per year by 2024.

4 – Cities and Länder: laboratories of innovationn

The role of *Länder* (federal states) is mainly to establish strategic frameworks for cities, support research and provide funding for local initiatives. As for German cities, some such as Freiburg and Bremen are at the forefront of innovation in sustainable transport: promotion of low-impact transport (walking, cycling, etc.) and common modes of transport, integrated planning and road traffic restrictions.

• CITY PLANNING AND REGULATION • Integrated planning has been common practice in many German cities and has been rejuvenated by the Sustainable Urban Mobility (SUMP) concept, which is heavily promoted by the European Commission. It takes the form of many tools that help to integrate modes of transport such as transport stations called "mobil.punkte" to encourage and facilitate the use of different modes (public transport, cycling, car). The first transport station was installed in Bremen in 2003, and since 2013 several have been set up in Hamburg (called "switchh"), Offenburg or Leipzig (GSMB, 2017).

- Bremen is actively working on modal integration concepts that combine walking and cycling with public transport and car-sharing systems. Part of this strategy is to reclaim public spaces for walking and cycling infrastructure, reduce the number of parking spaces in the city centre and increase parking costs.
- For example, Dresden is working on an urban transport plan for the city called 'Transport Development Plan plus 2025'. The plan aims at an integrated approach that considers the practices and policies of different sectors, different levels of authority and neighbouring communities. It aspires to integrate the areas of action creating an open and participatory process through round tables involving all stakeholders.

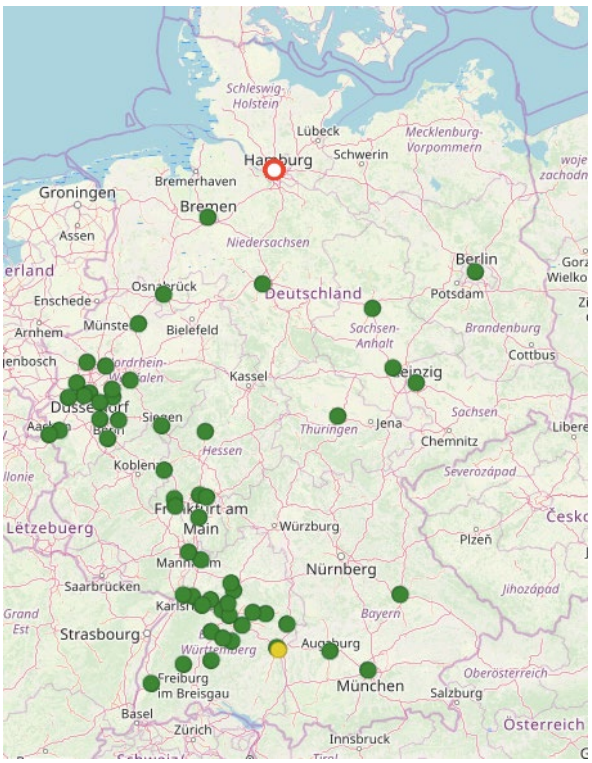
German regulations enabled the creation of forbidden zones for polluting vehicles since 2007. Vehicles are identified by labelling based on the European Emission Standards and on 4 levels. The classification encourages petrol vehicles, which have a green label if they comply with the 1993 EURO I standard, while diesel vehicles must comply with at least the 2006 EURO V standard. This measure fights above all against local pollution and its climate benefits and its impact on the volume of road transport remains uncertain.

There are about 60 restricted areas in Germany. The largest is in the Ruhr and covers 13 adjacent municipalities, including Dortmund and Essen. The centres of Berlin and Munich, Leipzig and its surroundings, Düsseldorf, Cologne, etc. are also covered. However, all these areas except Neu-Ulm are only prohibited for unlabelled vehicles (Clean Energy Wire, 2018) (Fig. 8).

FIGURE 8

GERMAN CITIES WITH A TRAFFIC RESTRICTION POLICY –

Source : Umweltzonen Bundesamt



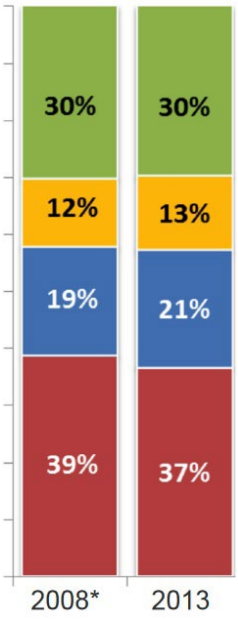
Paradoxically, these local traffic restriction measures have been facilitated thanks to the action of the NGO Environmental Action Germany (DUH), which, faced with persistent pollution threshold exceedances, has taken nearly 30 local administrations to court. At first instance, the courts in Stuttgart – home of car manufacturers Daimler and Porsche – and in Düsseldorf ordered that nitrogen dioxide levels be reduced below EU limits, including if necessary, by banning diesel vehicles. The legality of this unpopular measure was challenged and appealed by the Federal Administrative Court in Leipzig. In a landmark decision in February 2018, the court ruled that local bans to enforce European air quality rules were legal, but did not impose their implementation on communities if they exceeded the permitted thresholds (DW, 2018). The decision paves the way for the banning of certain vehicles, but the decision – including details of the timetable, affected areas, etc., belongs to local governments. Hamburg, which is also the largest German city not to have a restricted traffic zone, is the only city to have taken advantage of this new possibility so far. In the spring of 2019, it banned diesel cars and lorries from two streets.

In 2019, a group of 30 German economists called for the introduction of a city-toll for private cars as a more efficient solution than diesel bans (RWI, 2019). **The creation of city toll has been discussed since at least October 2012 with cities like Tübingen expressing interest for this tool. However, today municipalities are not allowed to impose city tolls. Regulations on state level ('Länder') need to be altered to allow cities to introduce city tolls. In the aftermath of the Dieselgate, this option came up on the political agenda.**

• A RISING PUBLIC TRANSPORT MODAL SHARE: MUNICH • After several decades of decline, the modal share of urban public transport has climbed over the last 10 years. The research project entitled "MOBILITY IN TOWNS – SRV 2013" led by the University of Dresden, shows that the individual motorised transport share in the 25 biggest German cities went from 39 to 37% between 2008 and 2013, enhancing the use of public transport and cycling (fig. 9). Walking remains the second mode of transport with 30% of overall trips (GPSM).

FIGURE 9

25 BIGGEST CITIES (+100,000 INHABITANTS) ASSESSED IN 2008 AND 2013 – *Source :* GPSM, *Spotlights n°1.*



Cities like Hamburg, Munich or Hanover have established quality public transport systems generating an increase in overall travellers. Success factors are safety and security, comfortable and accessible vehicles such as low-floor buses and trams, reliable and regular schedules and an economically viable system.

Local transit systems are financially supported by the federal government, state government and municipalities. It is estimated that users pay on average one third of the total local public transport budget in Germany, with considerable variations between cities or regions: in Berlin for example, 49% of public transport is funded by ticket revenues (Bormann et al. 2010).

EXPERIENCE FEEDBACK

MUNICH: A LOW-CARBON MOBILITY FOR ALL USERS

The city of Munich has been operating a mobility management programme called "Gscheid mobil" since 2006 – "Gscheid" is a Bavarian-Austrian term meaning both "quality" and "intelligence". This long-term strategy with an annual budget of around 1.5 million euros, that aims to support citizens, tourists and businesses in their individual mobility planning. It is also integrated in urban and transport planning to foster new forms of residential development or reduction of parking spaces.

People are offered information and mobility services in situations where they are more open to change (birth of a child, moving to another city, retirement). For instance, every new citizen receives a folder containing information material on mobility and transport as well as on leisure activities in Munich. As half of the 85,000 yearly newcomers are foreign nationals, the folder contains a summary in English, French, Italian, Spanish and Polish. Further information such as a cycling map, public transport timetables or test tickets can be ordered individually, easily and free of charge. According to evaluations led by the City of Munich, information packages including a ticket for testing public transportation can increase the use of public transit by 7.6 percentage points and decrease the use of cars by 3.3 percentage points, leading to emission reductions of approximately 12,000 tons CO_2/year (Nallinger, 2007).

In their compulsory integration courses at Munich's educational institutions, migrants learn the German language and culture via teaching materials covering also the topic of sustainable mobility. The pilot project "My bike – My Munich" specifically addresses women and youth refugees and offers cycling courses, joint excursions, training to become a cycling teacher as well as a bicycle repair workshop. To avoid young families automatically buying a car when expecting, the project "Go!Family – en route with a baby" addresses parents-to-be prior to birth and offers them to test different mobility options such as bicycle trailers, cargo bikes or electric bikes,

carsharing, special family tickets for public transport, etc.

Mobility management for businesses exists since 2001 and includes workshops and consulting services on site. The aim is to optimize the locational mobility processes of an enterprise. The project is run by the city's department for business development which facilitates the access to companies considerably. The average gain is estimated at 3,600 tons CO_2/a per trained business (July 2012).

Finally, the campaign "Radlhauptstadt" (cycling capital) received international attention for its innovative approach and measurable success (budget: 1 million euros per year). The programme combined investments in cycling infrastructure with a campaign that actively promoted cycling. Interconnected cycling corridors, bicycle parking facilities and bike+ride facilities for seamless modal interchange were vital for the success of this programme. For the entire transport strategy, the City of Munich estimates a reduction potential of 60,000 t CO_2/year (Schreiner 2010).

Source : Ville de Munich, Department of Labour and Economic Development, 2017

BOX 7

• REDUCING THE VOLUME OF ROAD TRANSPORT • A variety of initiatives and innovation are being used to facilitate the use of public transport and other alternative modes. In Cologne, for example, an online information platform, a Verkehrskalender (traffic calendar) provides information about current traffic conditions, route disruptions and construction projects, as well as advice on possibilities to use alternative modes to avoid delays, making travelling within Cologne easier for everyone. Frankfurt developed parking ticket machines into parking and charging stations to recharge electric vehicles and thus provides basic infrastructure for e-mobility. Mobile apps such Match Rider aims to ensure cars are full during home to work trips notably in semi-urban and rural areas. It helps to put people in contact with one another by displaying their meeting points. Tools like these are being used in Berlin but also in Heidelberg and Stuttgart with the company Match Rider Go (GSMB, 2017).

City logistics concepts have been applied in Germany with varying degrees of success.

They target freight transport and aim to improve efficiency in the delivery and collection of goods, consolidating trips, increasing load factors and reducing handling and transaction costs. Among the solutions that have been implemented in Germany are:

- regulations (traffic restriction, low emissions zones),
- transport pricing and taxes,
- transport planning and
- the development of infrastructure dedicated to urban freight (lorry lanes, delivery and loading spaces, urban consolidation centres).

Many cities in Germany have implemented dedicated loading zones, either as zones where private parking is restricted or as separated space with dedicated infrastructure. Often delivery or loading in these zones is restricted to time periods. Some public authorities provided research and development funds and regulative support for urban consolidation centres. Urban consolidation centres provide facilities where deliveries can be consolidated for the last kilometres of the trip into the target area. It is intended that the consolidation of deliveries leads to a high level of vehicle use and to the mitigation of impacts on local environment and traffic.

Cooperation is key in urban logistics; its efficiency is often limited by competition between leaders. Consequently, many urban consolidation centres have closed or are operating below their capacity.

Conclusion

The importance of the automotive and the logistics sectors places Germany in an ambiguous situation, giving it both expertise to lead the transition of transport and a strong interest in the status quo. It is the latter factor that seems to be prevailing for the time being despite technological progress and political momentum at national and local levels. At the local level, cities and regions have seen the share of public transport and cycling increase over the past ten years or so, and are demonstrating innovation, combining organisations, urban planning and technology, support by the companies and research centres in their areas.

REFERENCES

DATA BASES :

• Enerdata (2019) Global Energy & CO_2 data. Accessed 02/07/2019.

• European Environment Agency (2018) Eionet Central Data Repository. Accessed 02/07/2019. [online]

• OICA (2019) 2017 Production statistics. Accessed le 30/07/2019 [online]

REPORTS :

• BDI (2018). Policy Paper: Energy And Climate Policy. Retrieved from: https://english.bdi.eu/

• Cours des Comptes (2011). Les prélèvements fiscaux et sociaux en France et en Allemagne. Retrieved from: https://www.ccomptes.fr/

• FÖS. (2018). A comparison of CO_2-based car taxation in EU-28, Norway and Switzerland. Retrieved from: http://www.foes.de/

• Fraunhoffer ISI (2017). Economic impact of introducing road charging for Heavy Goods Vehicles.

• ICCT – International Council on Clean Transportation Europe (2018). USING VEHICLE TAXATION POLICY TO LOWER TRANSPORT EMISSIONS. Retrieved from: https://theicct.org/

• ICCT – International Council on Clean Transportation Europe (2018). European vehicle market statistics – Pocketbook 2018/19. Retrieved from: https://theicct.org/

• Transport & Environment. (2018). CO_2 EMISSIONS FROM CARS: the facts. Retrieved from: https://www.transportenvironment.org/

• WLPGA (2018). Autogas Incentive Policies – A country-by-country analysis of why and how governments encourage Autogas & what works. Retrieved from: https://www.wlpga.org/

SCIENTIFIC PAPERS :

• Anderson-Teixeira, Kristina J., P.K. Snyder, and Evan H. Delucia. (2011) "Do Biofuels Life Cycle Analyses Accurately Quantify the Climate Impacts of Biofuels-related Land Use Change?" University of Illinois Law Review 2011 (2): 589–622.

• BMF (2012). Federal Ministry of Finance, Grundlagenwissen zum Benzinpreis und seiner En – twicklung, Berlin.

• BMUB (2016). Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety, Climate Action Plan 2050, Berlin.

• BMVBS (2012). Federal Ministry of Transport, Building and Urban Development, Mobility and Fuel Strategy, Berlin.

• Bormann, R., T. Bracher, O. Dümmler, L. Dünbier, M. Haag, H. Holzapfel, F. Kunst, O. Mietzsch, J. Mirbach, and H. Mossakowski. 2010. "Neuordnung Der Finanzierung Des Öffentlichen Personennahverkehrs." Bündelung, Subsidiarität Und Anreize Für Ein Zukun – ftsfähiges Angebot. Bonn.

• Böttcher, C. & Müller, M. 20 November 2016. "Insights on the impact of energy management systems on carbon and corporate performance. An empirical analysis with data from German automotive suppliers". Journal of Cleaner Production, Volume 137.

• Damert, M. & Baumgartner, R. 6 June 2017. "Intra Sectoral Differences in Climate Change Strategies: Evidence from the Global Automotive Industry". Business Strategy and the Environement

• Doll, Claus, and Axel Schaffer. 2007. "Economic Impact of the Introduction of the German HGV Toll System." Transport Policy 14 (1) (January): 49–58. doi:10.1016/j.tranpol.2006.09.001.

• ECMT. 2007. Cutting Transport CO_2 Emissions: What Progress? Paris: OECD. (Lah, 2017)

• Flach, B., Bendz, K. and Lieberz, S. 2012. EU Biofuel Annual 2012, USDA Foreign Agricultu – ral Service, GAIN Report No. NL2020.

• Federal Government of Germany, 2008. Freight Transport and Logistics Masterplan. Berlin, Germany: Die Bundesregierung (The Federal Government) represented by Bundesministerium für Verkehr, Bau und Stadtentwicklung (Federal Ministry of Transport, Building and Urban Affairs). Retrieved from: https://www.bmvi.de/ [Accessed 27-09-2018].

• Federal Government of Germany, 2016. Climate Action Plan 2050. Retrieved from: https://unfccc.int/ [Accessed 11-09-2018].

• Federal Ministry of Transport, Building and Urban Development, 2010. Freight Transport and Logistics Action Plan – Logistics Initiative for Germany. Berlin, Germany: Federal Ministry of Transport, Building and Urban Development. Retrieved from: https://www.bmvi.de/

• Germany Trade and Invest, 2017. Electric Mobility in Germany. (ISSUE 2017/2018), Retrieved from: https://www.gtai.de [Accessed 20-09-2018].

• Gössling, S. & al. December 2016. "Inside the black box: EU policy officers' perspectives on transport and climate change mitigation". Journal of Transport Geography, Volume 57.

• Held, M. & al. September 2018. "Current challenges for sustainable product development in the German automotive sector: A survey-based status assessment". Journal of Cleaner Production, Volume 195

• Hirte, Georg, and Stefan Tscharaktschiew. "Income Tax Deduction of Commuting Expenses in an Urban CGE Study: The Case of German Cities." Transport Policy (0). doi:10.1016/j.tranpol.2012.05.003. Retrieved from: http://www.sciencedirect.com/

• Holland, Stephen P. 2012. "Emissions Taxes Versus Intensity Standards: Second-best Envi – ronmental Policies with Incomplete Regulation."

Journal of Environmental Economics and Management 63 (3) (May): 375–387. doi:10.1016/j.jeem.2011.12.002.
• IEA. 2011. World Energy Outlook 2011. Paris: International Energy Agency, OECD/IEA.
• –––. 2012. World Energy Outlook 2012. International Energy Agency, OECD/IEA. www.iea.org.
• Kaczor, Bianca. 2011. Mobilitätsbildung: Weniger Verkehr im Umfeld von Schulen und Kitas durch Mobilitätsbildung und PRM. Workshop-presentation. Köln. Online available at www.vrsinfo.de
• Klebaner, S. 2018. Isolated car manufacturers? The political positions of the automotive industry on the real driving emissions regulation. Int. J. Automotive Technology and Management, Vol. 18.
• Lah, O. (2017). Continuity and Change: Dealing with Political Volatility to Advance Climate Change Mitigation Strategies—Examples from the Transport Sector. Sustainability, 9(6). https://doi.org/10.3390/su9060959
• Lah, O. (2017). Decarbonizing the transportation sector: policy options, synergies and institutions to deliver on a low-carbon stabilisation pathway, WIREs Energy and Environment, Volume 6 Issue 5, DOI:10.1002/wene.257. Retrieved from: http://onlinelibrary.wiley.com/
• Lah, O. (2016). Factors of Change: The influence of policy environment factors on climate change mitigation strategies in the transport sector. Transportation Research Procedia, 25, 3499–3514. https://doi.org/10.1016/j.trpro.2017.05.265
• Levy, DL & Rothenberg, S. (2002). Heterogeneity and change in environmental strategy: technological and political responses to climate change in the global automobile industry. Organizations, policy and the natural environment: institutional and strategic perspectives. 2002:173-93.
• Mazur, C. & al. March 2015. "Assessing and comparing German and UK transition policies for electric mobility". Environmental Innovation and Societal Transitions, Volume 14.
• Mazur, C. & al. September 2015. " Understanding the drivers of fleet emission reduction activities of the German car manufacturers". Environmental Innovation and Societal Transitions, Volume 16
• Metzler, D. & al. 2019. " Is it time to abolish company car benefits? An analysis of transport behaviour in Germany and implications for climate change". Climate Policy, Volume 19.
• Morris, C., 2015. Low gas prices as opportunity for environmental taxation. Available at: https://energytransition.org/2015/11/low-gas-prices-as-opportunity-for-environmental-taxation/ [Accessed 26-09-2018].
• Nallinger, Sabine. 2007. Neu in München – gleich gewusst wo's langgeht. Die Mobilitätsbera – tung für Neubürger in München. Presentation at SRL-ÖPNV – Tagung 2007 „Stadtmobilität – Mobilität in der Stadt! Beispiele des modernen Mobilitätsmanagements", 15./16. March 2007, Munich.
• O'Donnell, T. W., 2018. Germany's Real LNG Strategy. Available at: https://berlinpolicyjournal.com/germanys-real-lng-strategy/ [Accessed 20-09-2018].
• Rietig, K. 2012. Climate policy integration beyond principled priority: a framework for analy – sis. Centre for Climate Change Economics and Policy, Working Paper No. 99
• Schallaböck, Karl Otto, Rike Carpantier, Manfred Fischedick, Michael Ritthoff, Georg Wilke (2012) Modellregionen Elektromobilität : Umweltbegleitforschung Elektromobilität, Wuppertal Paper 6, Wuppertal: WI.
• Scruggs, L. 2001. Is There Really a Link between Neo-Corporatism and Environmental Performance? Updated Evidence and New Data for the 1980s and 1990s, British Journal of Political Science 31 (4):686-692.
• UBA 1999. Umweltauswirkungen von Geschwindigkeitsbeschränkungen, Dessau: UBA.
• UBA 2009. Politikszenarien für den Klimaschutz V – auf dem Weg zum Strukturwandel. Treibhausgas-Emissionsszenarien bis zum Jahr 2030, Dessau: UBA
• UFOP, 2017. Biodiesel 2016/2017 Report on Progress and Future Prospects – Excerpt from the UFOP Annual Report. Berlin, Germany: UNION ZUR FÖRDERUNG VON OEL – UND PROTEINPFLANZEN E. V. (UFOP). Available at: https://www.ufop.de/files/5115/1309/0426/UFOP-Biodiesel_2016-2017_EN.pdf [Accessed 20-09-2018].
• –––.2010a. Umweltschädliche Subventionen in Deutschland – Aktualisierung für das Jahr 2008, Dessau: UBA.
• _____ 2010b. CO_2-Emissionsminderung im Verkehr in Deutschland. Mögliche Maßnahmen und ihre Minderungspotentiale. Ein Sachstandsbericht des Umweltbundesamtes. Dessau: UBA
• –––. 2010. Road Pricing for Cars in Germany, An evaluation from an environmental and transport policy perspective, Dessau: UBA

PRESS AND COMMUNICATIONS :

• AutoPlus (23/09/2019). Francfort 2019 : la fréquentation en chute libre ! Retrieved from: https://www.autoplus.fr
• BAFA – Bundesamt für Wirtschaft und Ausfuhrkontrolle. (2018). Electromobility (Environmental bonus). [blog post] BAFA. Retrieved from: http://www.bafa.de/
• Biofuels International, (23/05/2019). German biodiesel production figures for 2018 released by VDB. [blog post] Biofuels international. Retrieved from: https://biofuels-news.com/
• Bloomberg (06/09/2019). Volkswagen's Road to Riches or Ruin Starts in This Factory. Retrieved from: https://www.bloomberg.com/

• BVDI. Verkehrsverflechtungsprognose 2030. BVDI. [blog post] Retrieved from: https://www.bmvi.de/
• Clean Energy Wire. (28/02/2018). Diesel driving bans in Germany – The Q&A. Clean Energy Wire [blog post]. Retrieved from: https://www.cleanenergywire.org/
• Clean Energy Wire. (06/08/2018). How Germany is greening its growing freight sector to meet climate targets. Clean Energy Wire [blog post]. Retrieved from: https://www.cleanenergywire.org/
• City of Munich, Department of Labour & Economic Development. 2017. The Mobility Management Programme 'Munich – Gscheid Mobil'. Urbact [blog post]. Retrieved from: https://urbact.eu/
• DB. https://gruen.deutschebahn.com/en/projects
• Deutsche Bank. (09/05/2019). Logistik koppelt sich von Industriekonjunktur ab – aber wie lange noch? Deutsche Bank [blog post] Retrieved from: https://www.dbresearch.com/
• DW. (05/09/2017). European Commission finds German automakers illegally colluded on emissions technology. Retrieved from: https://www.dw.com/
• DW. (17/12/2018). EU strikes deal to slash emissions for new cars. Retrieved from: https://www.dw.com/
• EEA. (24/06/2019). Average CO_2 emissions from new cars and new vans increased in 2018. EEA [blog post]. Retrieved from: https://www.eea.europa.eu/
• Financial Times. (25/10/2018). Rhine drought leaves Europe's industry high and dry. Retrieved from: https://www.ft.com
• Insurance Journal. (24/07/2019). Rhine River Shipping Faces Another Historic Shutdown as Drought Hits Water Levels. Retrieved from: https://www.insurancejournal.com
• JOC. (26/10/2018). Low water halts all Rhine barge shipping on Kaub-Basel stretch. Retrieved from: https://www.joc.com
• KBA. (04/01/2019). Pressemitteilung Nr. 01/2019 – Fahrzeugzulassungen im Dezember 2018 – Jahresbilanz. KBA [blog post]. Retrieved from: https://www.kba.de/
• Reuters. (19/09/2018). Germany to reach target of 1 million electric cars later than planned. Reuters [blog post]. Retrieved from: https://www.reuters.com/
• RWI. (18/05/2019). Weniger Staus, Staub und Gestank per sozial ausgewogener Städte-Maut. RWI [blog post]. Retrieved from: http://www.rwi-essen.de/
• The Local. 28/01/2019. German government rejects speed limit on Autobahn. The Local [blog post]. Retrieved from: https://www.thelocal.de/
• UBA. 04/09/2013. Climate Impacts: Field of Action Transport. Retrieved from: www.umweltbundesamt.de
• VDA. Facts and Figures – Overview. VDA [blog post]. Retrieved from: https://www.vda.de/en/services/facts-and-figures/facts-and-figures-overview.html