



German Advisory Council
on the Environment

Time to take a turn: climate action in the transport sector

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Summary

The transport sector as the greatest challenge to climate policy

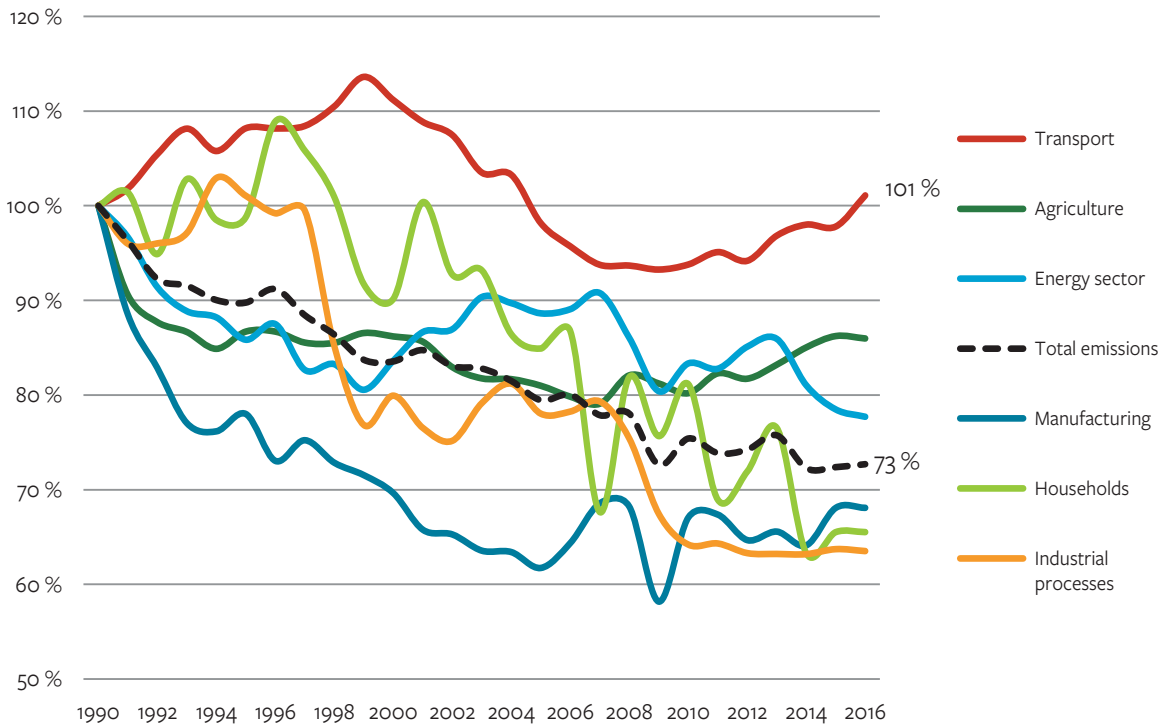
With the global average temperature roughly 1 °C higher than a century ago, anthropogenic climate change is already having a worrying impact on civilization and the environment. In the Paris Agreement, the goal was agreed upon to keep warming “well below 2 degrees Celsius”. If that limit is exceeded, the consequences could be dramatic and irreversible. Extreme weather events like the storms and floods of 2017 should serve as a wake-up call for the global community.

Like the EU, the German government has set a goal for itself of reducing greenhouse gas emissions by 80 % to 95 % below the level of 1990 by 2050. The German Advisory Council on the Environment (SRU) recommends a 95 % reduction so that Germany can properly contribute to the climate protection goals agreed in Paris. To this end, the economy needs to be comprehensively decarbonized – fossil energy combustion must be reduced to the extent possible. All sectors are called on here to dramatically reduce their greenhouse gas emissions.

At present, the transport sector accounts for around one fifth of Germany’s greenhouse gas emissions. Since 1991, other sectors have reduced their emissions considerably, while those from transport have actually risen slightly (Figure 1). Most of these greenhouse gases are emitted on roads. More mileage, larger engines, and heavier vehicles have eaten up improvements in vehicle efficiency. By midcentury at the latest, mobility needs to be nearly completely carbon-neutral. The Paris Agreement leaves us with a very tight carbon budget, requiring immediate and resolute change. The German government’s Climate Action Plan 2050 sets an ambitious interim target of a 40–42 % greenhouse gas reduction from transport by 2030.

Figure 1

Greenhouse gas emissions from selected sectors in Germany (1990–2016)



SRU 2017; data source: UBA 2017

The transformation of the transport sector as an opportunity to reduce environmental and health impacts

Road traffic in particular detrimentally impacts nature, the environment, and human health in many ways. In 2015, it made up 38 % of anthropogenic nitrous oxide (NO_x) emissions, making it the main source. In many cities the annual limit value for nitrogen dioxide (NO₂) is exceeded. Road traffic is also a main source of particulate matter. Nearly half of Germans say that noise from road traffic is too loud near their homes. Transport also consumes considerable land area. Low-income households especially suffer from air pollution, noise, and a lack of high-quality open spaces. Finally, transport is a major factor in the loss and fragmentation of habi-

tats for plants and animals. The transformation of Germany’s transport sector (Verkehrswende) is an opportunity to reduce this wide range of negative impacts and improve people’s living conditions.

The transformation of the transport sector as an important future task for politics and business

Germany’s transport system has been mainly reliant on cars for decades. Change will be difficult. Nonetheless, the future of mobility is increasingly being openly and controversially discussed. Climate action is an important factor in the debate, as is the political and legal discussion about air quality in cities, which the diesel scan-

dal has only made timelier. International trends are also challenging the automotive sector. China's announcement to have 10 % electric cars in new sales starting in 2019 forces German carmakers to take action. At the same time, it is clear that technological developments as digitalization – especially driverless cars – will fundamentally change the mobility landscape. An innovative and sustainable transport policy is thus not only crucial in terms of environmental and climate policy, but also a central condition for the future competitiveness of German industry. At the same time, the public has to accept change in an area that directly affects the daily lives of so many people. Politicians therefore have to plan the impending transformation of the transport sector in a dialogue with all stakeholders – and then courageously implement it.

The need to combine avoidance, shifting, efficiency, and new powertrains

In light of the multifarious negative environmental and health impacts of transport, sustainable transport is only possible if different strategies are combined. Mobility patterns have to change, as does the way transport is organized in many fields. Reducing motorized individual transport is a central element of a sustainable transport system that protects the climate; smart, integrated mobility solutions need to be ramped up. Avoiding transport and shifting it to railways, public transportation, cycling, and walking will not only reduce greenhouse gas emissions and energy consumption, but also lessen additional problems brought about by transportation, such as land consumption, noise, and the risk of accidents.

A technological transformation in powertrains that supports the switch from fossil to renewable energy will play an important role in decarbonizing transport. At the same time, an aggressive efficiency strategy also needs to be pursued. On the one hand, the energy efficiency of cars and trucks with combustion engines must be improved because a large number of these vehicles will still be purchased in the next 15 years. Some of them will be on the road well into the 2040s. Unless the energy efficiency of vehicles is constantly improved, cumulative emissions from road traffic alone are threatening to exceed the carbon budget for the transport sector that is consistent with the Paris Agreement within the next 15 years. On the other hand, vehicles with alternative powertrains

also have to be as energy-efficient as possible to minimize energy consumption – and hence, the build-up of renewable energy plants is needed. Switching to vehicles with alternative powertrains – including the required infrastructure for charging and electricity generation – will increase the demand for certain raw materials. Most of these are extracted and processed outside the EU – often with strong local and regional environmental, health, and social impacts. It quickly has to be worked towards an environmentally friendly and socially acceptable production of raw materials. In addition, at the end of their life products must be fed into a high-quality circular economy system. This will not only reduce the demand for primary raw materials and the associated environmental impacts, but also improve the overall ecological footprint.

The benefits of electric mobility

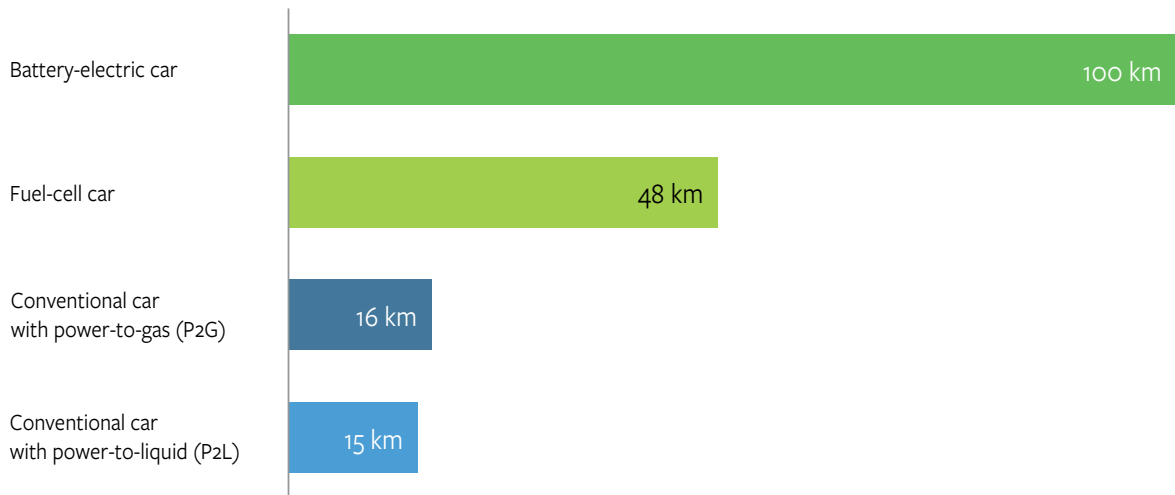
Because of its very high efficiency, direct electrification – i.e., the transition to electric mobility – is particularly suitable to fundamentally reduce the climate and environmental impacts of transport. In addition, electric powertrains do not produce any local pollution. On the other hand, the widespread use of synthetic fuels made from electricity would increase power demand several-fold because of the high conversion losses (Figure 2). Skyrocketing power demand would not only have tremendous ecological impacts, but also high economic costs. Greater use of biofuels from energy crops would worsen the land use competition for production of food and biofuels. In many cases it would not be socially or ecologically sustainable either. The focus should therefore be on modes of transport that can technically be electrified under reasonable economic conditions. In addition to railways, which have largely already been electrified, road traffic offers the most potential here.

The many advantages of electric mobility rule out a strategy of technology-neutrality in road passenger transport. Furthermore, in light of the privileged starting point for internal combustion engines, technology-neutral rules would disadvantage new technologies. Targeted technology support is a good way of overcoming the initial obstacles that new technologies face, such as with new energy supply infrastructure and initially higher production costs.

The SRU is of the opinion that the focus should primarily be on battery-electric vehicles in the beginning. Fuel-cell cars have lower efficiency levels and will have

o Figure 2

The range of cars with various technologies (15 kWh of primary energy consumption)



SRU 2017; data source: KREYENBERG et al. 2015, p. 15

a higher price tag for the foreseeable future, making them less promising for widespread use based on current knowledge. The SRU does believe that support for cars running on natural gas as a bridging technology is not expedient because such vehicles still emit relatively large amounts of carbon. Also, investments in highly efficient electric powertrains make more sense in the long run. Battery-electric powertrains are advisable as well for widespread use in light utility vehicles and delivery trucks. For long-distance road transport, trucks powered by overhead catenary systems are an option. In light of their useful lives, new vehicles need to be electric by the mid-2030s at the latest.

To the extent possible, the use of synthetic fuels and limited volumes of sustainable biofuels should be restricted to applications for which direct electrification is not technologically and economically feasible. Examples include most aviation and ocean shipping, for which no direct-electrification alternatives currently exist because fuels have a greater energy density than batteries. In terms of infrastructure that needs to be built, technologies that ensure long-term compliance with climate targets should be promoted so that expensive infrastructure does not need to be adjusted or build redundantly.

The SRU's recommendations for the new legislative period

The new legislative period should establish central strategic pathways for the transformation of the transport sector. The German government's Climate Action Plan 2050 and the climate action concept for road traffic foreseen in it provide a useful framework for climate policies in the transport sector. A consistent overall concept is needed in order to offer stakeholders planning security, thereby enabling long-term investment decisions. The SRU's recommendations below provide the necessary building blocks for such a concept with a focus on medium and long-distance traffic.

1. Reforming taxes and levies

The current system of energy taxes and levies has evolved historically. It contains a number of obstacles for efficient climate protection in the transport sector, particularly for greater use of renewable electricity. The SRU recommends that the German government work up a reform concept that tackles the challenges for climate ac-

tion, sector coupling, and fluctuating renewable power generation. Taxation rates for the various energy sources used in transportation should reflect each source's specific greenhouse gas content and energy content. The European Commission's proposal for a reform of the Energy Taxation Directive, which was not adopted in the end, is a good starting point. Overall, the SRU calls for the taxation system to be based more on ecology. For years, the share of environmental tax revenue has been dropping – and with it, the real levy burden on fuels.

First, the taxation privilege for diesel should start to come to an end. There is no ecological justification for a lower taxation of diesel fuel, nor does it take account of the negative health effects of emissions. The privilege for diesel has led to diesel vehicles becoming heavier and heavier with ever larger motors; the diesel engine's efficiency benefits have thus been offset. Likewise, the privilege for natural gas as a fuel in the transportation sector should not be extended again beyond 2026.

The higher levy burden on electricity relative to fossil fuels slows down the desired electrification of transport. As an energy source in transportation, the burden should therefore be taken off electricity, at least in relative terms. In addition, levies on electricity should be more dynamic so that users have a greater incentive to focus their power consumption on the characteristics of an energy supply based on renewables.

In general, drawing down the environmentally damaging subsidies should be a central goal in the new legislative period. In the transport sector alone, environmentally harmful subsidies are estimated at around 30 billion euros annually. This pertains to the travel allowance as well as the low flat-rate company car taxation.

2. Quotas for electric powertrains

For the necessary technological transformation to be rolled out quickly, a quota for electric powertrains should be introduced and gradually increased for cars and light utility vehicles. The advantage of quotas relative to other incentives to promote alternative drivetrains is that technological policy goals can be reliably reached. On the one hand, manufacturers have the planning security to invest in ramping up the market for these technologies; on the other, this approach makes it economically more attractive to start setting up the energy supply infrastructure needed.

The SRU proposes a binding quota for the share of purely electric vehicles (battery-electric and fuel cell cars) of at least 25 % of all new sales by 2025. Plug-in hybrids should also be counted towards that quota at a fraction of the amount for fully electric vehicles. In addition, it should be codified that the quota will be increased to at least 50 % by 2030, with a review of the exact number taking place no later than 2025 after an interim evaluation. This steep increase in the quota seems realistic as electric mobility is expected to grow significantly after a certain threshold is overcome.

3. Ambitious standards and fiscal incentives to improve vehicle efficiency

At present, European CO₂ emissions targets for passenger cars and light commercial vehicles are the principal tool towards improving vehicle efficiency. The SRU recommends that the German government quickly agree on ambitious targets for fleet average CO₂ emissions for the years 2025 and 2030. To take account of the increasing diversity in drive technologies and further improve the energy efficiency of all vehicles, the rules should be structurally overhauled. Fleet average energy efficiency standards should replace fleet average CO₂ emissions standards. In addition, they should be combined with minimum efficiency requirements for specific powertrains, especially for vehicles with internal combustion engines (“dual efficiency regulation”). A regulation for final energy consumption would also set incentives for the efficiency of electric vehicles. This approach would also take into account the fact that every type of energy generation impacts the environment. Technology-specific requirements can ensure that a minimum of affordable efficiency improvements are realized for each drivetrain technology. In the future, the standard should be based on real consumption on the road, not merely on measurements in the lab. Manufacturer-specific efficiency requirements should also no longer be relative to weight in order to strengthen incentives to reduce weight.

Unlike many other vehicle markets worldwide, the EU currently lacks CO₂ emission standards and other efficiency targets for heavy duty vehicles. The German government should support the introduction of ambitious European CO₂ emission standards or energy efficiency standards to take effect no later than 2025. Due to the short fleet renewal periods of heavy duty vehicles, specific

carbon emissions from road transport could be considerably reduced by 2030 in this way. The regulatory approach should not, however, focus solely on engine efficiency. Aerodynamics, a reduction of rolling resistance, and weight reductions provide further potential to improve overall energy efficiency.

In addition regulatory approaches at the European level, the SRU recommends strengthening fiscal efficiency incentives to improve the robustness of efficiency regulations and accelerate fleet renewal. A temporary bonus malus system should be launched to provide financial support for purchases of energy-efficient vehicles and disincentivize purchases of inefficient ones. In addition, vehicle taxes should continue to be based on carbon emissions; these incentives should be strengthened. Alternatively, vehicle taxation could be based on energy consumption.

4. Distance-based tolls for cars

Current toll systems mainly serve to pay for road use. In the future, however, it could be an important tool to shift, avoid, and steer traffic as well as to improve efficiency and accelerate fleet renewal. To better reflect the true costs in transport and to reduce carbon emissions, car tolls adopted in the previous legislative period should be further developed to produce distance-based toll rates. Autonomous vehicles are expected to become more common, so such distance-based tolls would help prevent unnecessary trips without passengers as well as a further increase in the number of trips taken and provide financial incentives for the intermodal use of autonomous vehicles in combination with public transportation. A more differentiated toll system could make sense in terms of ecology and traffic management, but data protection and consumer rights need to be taken into account as well, as does the technical feasibility of such a system.

5. Expanding energy supply infrastructure

A demand-oriented charging infrastructure must be built up quickly for electric powertrains to be widely successful on the market. The federal government should provide temporary financial support for these investments. The current federal program, which provides 300 milli-

on euros from 2017 to 2020, should therefore be continued and expanded. It is currently not clear how long this state financial support will be needed. Indeed, the threshold of affordability for the provision of charging infrastructure will not be reached simultaneously in all regions, so it may make sense to adopt a spatially differentiated support system at some point.

Roughly 85 % of all charging takes place in privately owned spaces, so binding requirements should be adopted at EU level to ensure that charging infrastructure is included in new buildings. The current legal framework makes it hard for tenants and joint building owners to install charging stations for electric cars at their own parking space. As planned by the legislature, changes need to be made to building codes and laws covering landlords and tenants so that charging stations on private property become more common. In addition, private-sector employers should be obligated to provide charging infrastructure on company parking spaces.

Catenary lines are a technically feasible option for heavy trucks covering long distances. Freight transport over long distances currently account for some 80 % of carbon emissions from road traffic. This option would take advantage of the efficiency benefits of direct electrification. Studies have found that electrifying a third of the German autobahn network (some 4,000 km) would increase the share of electrified freight transport over long distances to around 60 %. If the demonstration projects, which include some in Germany, are successful, the SRU recommends that the federal government plan to electrify highly frequented sections of the autobahn with suitable start-end relations, which could be financed via the toll on trucks.

6. Extraction of required raw materials and circular economy

In the use-phase, vehicles with electric drives show lower environmental impacts than vehicles with combustion engines due to less noise and lower emissions of CO₂, NO_x and particulate matter. Nevertheless, in downstream processes such as extraction and processing of raw materials, the environmental impacts shift because raw materials other than petroleum are needed for engines and batteries as well as for the facilities to generate renewable electricity. Therefore, the demand for lithium, rare earth elements, cobalt, platinum, and copper will increase significantly.

Internationally agreed environmental and social standards must be met in the medium term. The German government should considerably expand such tools as raw material partnerships, certification, and international cooperation and in this context better coordinate the work of the respective ministries responsible for different aspects of environmental protection, economy, and economic cooperation and development. In addition, it should strive for the establishment of a raw material inventory at the national and European level so that the business sector can plan the establishment of recycling structures prospectively and make long-term estimates about the volumes of secondary raw materials expected. The need for research for innovative treatment and recycling technologies could be derived from that inventory, as could deficits in the creation of needed infrastructures. In the medium term, the inventory should not only cover vehicles, but also other products, in particular technologies installed to generate and store energy – but also consumer items such as electrical and electronic equipment. In this way, it can be determined whether there are similar, simultaneous waste flows for different products that can be joined together for recycling. The inventory could be hosted at the German Institute for Geosciences and Natural Resources (BGR) in cooperation with the German Environment Agency (UBA) in order to be directly connected to the topic of raw material demand.

The German government should further require a “recycling pass” when licensing new vehicle types (all types of power trains and vehicles). This pass is aimed to provide information from manufacturers about raw materials (the basis of the inventory) used, dismantling procedures, and plans for recovery and recycling. To this end, a comprehensive end-of-life concept should be elaborated during product development to allow for dismantling and high-quality recycling.

The term “(material) recycling” should be clearly defined as requiring “use of the same or higher quality” in the relevant laws and ordinances. The German government should promote the specification of the terminology in this manner at the European level. State-of-the-art recycling technologies should be used to ensure high-quality material cycles. To step up the creation and concrete implementation of specific requirements for electric vehicles, the German government should work at the European level to ensure that the End-of-Life Vehicles Directive and the Batteries Directive are quickly amended and take into account the challenges from electric mobility with an eye to high-quality recycling.

7. Further development of transport infrastructure planning towards federal mobility planning

The Federal Transport Infrastructure Plan is the most important steering tool for transport infrastructure planning that is in the competence of the federal level. From the viewpoint of climate action and sustainability, transport and mobility concepts are pivotal that are based on spatial specifics and existing infrastructure and take account of transport, spatial, health, and environmental effects. This is not sufficiently the case in the current Federal Transport Infrastructure Plan. Furthermore, construction and expansion projects are mainly awarded based on a cost-benefit analysis although these analyses can only be compared methodologically to a limited extent across various types of projects and modes of transport. In addition, the Federal Transport Infrastructure Plan 2030 missed 11 of the German government’s 12 environmental targets.

The SRU therefore recommends that federal transport infrastructure planning be further developed to provide an integrated federal mobility planning that covers all cross-country modes of transport (roads, railway, shipping, and aviation), including a consistent nationwide airport planning. This approach would mean a move away from justifications of transport planning based purely on demand towards integrated spatial and transport planning. This integrated planning combined with an efficient transport system should aim to reduce overall traffic and minimize its environmental and health impacts even as mobility requirements are met.

8. A careful reform of the Passenger Transportation Act

In rural areas, scheduled public traffic does not always provide sufficient mobility; even a reliable taxi service is not economically viable in some regions. Flexible services, sometimes on a volunteer basis, have come about as a result, but they sometimes face permitting obstacles. Digitalization has brought about new app-based services, which do not always fulfill legal requirements for commercial transport.

Against this backdrop, a reform of the Passenger Transportation Act is currently being discussed. A rather far-reaching deregulation of passenger transport has been proposed. Supporters hope that new services will ensure mobility in rural areas in particular. But it is not certain that the services will actually be offered there. In addition, deregulation could weaken existing public transportation, particularly in cities. The SRU therefore calls for a balanced approach: new, innovative services should be integrated in the existing local transport plans. In addition, steps should be taken to ensure that classic flexible services, such as on-demand buses, receive permits.

9. Reducing emissions in ocean shipping

In the long run, synthetic energy carriers based on renewable energy should be used in ocean shipping. Already, it is technically possible to switch ship drivetrains from heavy oil and diesel to liquefied natural gas (LNG), thereby reducing greenhouse gas emissions and air pollution significantly. Renewable gas can successively replace fossil gas. However, the use of LNG faces major obstacles. It will be hard to refinance a switch to LNG in light of the surplus capacities in ocean shipping. In addition, refueling infrastructure in ports is insufficient or missing.

Decarbonizing maritime transport will require political steps at all levels. Because seaborne freight transport is a global industry, greenhouse gas reduction targets towards complete decarbonization by 2050 should be a goal worked on in the framework of the International Maritime Organization (IMO). The German government should also work towards an ambitious agenda at the European level. A European carbon price for shipping fuels is needed to prevent fuel bunkering from moving to ports without a carbon price. European initiatives to reduce pollutant emissions in ocean shipping have shown that Europe can play a pioneering role; and can influence the IMO regulations.

The Environmental Ship Index – a voluntary bonus system established in all major European ports – should be further developed. On the one hand, the index should focus more on climate action; it primarily covers air pollution at present. On the other, it should be redesigned as a malus system in which docking fees would be higher for ships with high emissions of pollutants and greenhouse gases.

Nationally, the SRU recommends repealing the taxation privilege for shipping fuels as a first step towards true-cost pricing. LNG supplies should be available for ships without additional cost. The German government should therefore first work with the federal states to harmonize the rules.

10. Strengthening climate action in aviation

A climate-neutral design for aviation requires steps at the international, European, and national level. Internationally, CORSIA – the market-based instrument to reduce the greenhouse gas effects of aviation – should be made more ambitious in the short term. In particular, there should be additional offset requirements if bio-fuels or fuels made from electricity are used in order to account for their non-CO₂ climate impacts.

At the European level, reduction targets for aviation within the European Emissions Trading Scheme should be made stricter and brought in line with the goals for other sectors. Furthermore, the complete range of climate impacts from aviation (non-CO₂ effects) should be taken into account in the midterm. In addition, the EU's VAT Directive should be amended so that value-added taxes are also charged on international commercial flights.

Nationally, kerosene should be taxed to reduce subsidies for aviation. Coordination with a larger group of states is needed to avoid incentivizing airplanes flying with more fuel than is needed for the next flight. The exemption for kerosene taxation should be revised in existing bilateral aviation treaties. In addition, the air traffic tax should be further developed and differentiated based on climate impacts.

11. Speeding up the growth of renewables

Far-reaching direct and indirect electrification of transport and other consumption sectors will increase power demand considerably even with ambitious efficiency policies. Renewable power generation capacities must be considerably expanded to meet the additional power demand with low greenhouse gas emissions. The additional capacities called for in the Renewable Energy Act (EEG) of 2017 are insufficient for a transition to rene-

wable power for transportation. Furthermore, it is questionable whether the targets will be reached. The so-called extension corridor should be proactively based on power consumption scenarios that fulfill demanding climate goals requiring the electrification of consumption sectors in the future. In addition to adjusting the short and midterm extension corridor in the EEG, the long-term 2050 goals for the share of renewables in energy supply are far too low at 60 % of energy supply and 80 % of power supply. German energy supply needs to be nearly completely renewable by no later than the middle of the century.

Presumably, Germany will not be able to meet its energy demand completely with domestic sources in the long run, especially when it comes to demand for synthetic fuels in shipping and aviation. The German government should work at an early stage on strategies for suitable locations that take the interests of production countries

into account. Even if synthetic fuels are produced on an industrial scale outside Germany, this important technology should receive industrial and research policy support.

Outlook

The transport sector is undergoing major changes that are driven by technology – but are also necessary in terms of climate, environmental, and health policy. Internationally, the transport sector is very dynamic. The focus is currently on rolling out electric vehicles. One should keep in mind that the transformation of Germany's transport sector is not only about a switch to other powertrain technologies – and that climate action is not the only aspect to consider. Rather, change in the transport sector offers an opportunity to rethink mobility and refocus it more on people's needs.

The German Advisory Council on the Environment

Prof. Dr. Claudia Hornberg (Chair)

Professor of Environment and Health at the School of Public Health, University of Bielefeld

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Professor of International Nature Conservation at the Goethe-University of Frankfurt

Prof. Dr. Christian Calliess

Professor of Public Law and European Law at the Department of Law at the Freie Universität Berlin

Prof. Dr. Claudia Kemfert

Professor of Energy Economics and Sustainability at the private University “Hertie School of Governance” in Berlin and Head of the department Energy, Transportation, Environment at the German Institute of Economic Research (DIW Berlin)

Prof. Dr. Wolfgang Lucht

Alexander von Humboldt Chair in Sustainability Science at the Department of Geography at Humboldt University Berlin and Co-Chair of the Department of “Earth System Analysis” at the Potsdam Institute for Climate Impact Research

Prof. Dr.-Ing. Lamia Messari-Becker

Professor and Director of the Institute of Building Technology and Construction Physics at the University of Siegen

Prof. Dr.-Ing. Vera Susanne Rotter

Professor and head of the group “Solid waste management” at the Technische Universität Berlin

Secretariat of the German Advisory Council on the Environment

Luisenstrasse 46, 10117 Berlin, Germany

Tel.: +49 30 263696-0

info@umweltrat.de

www.umweltrat.de

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