German Partnership
for Sustainable Mobility

*Sustainable Mobility – Made in Germany*

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# *Clean Air – Made in Germany*


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## SCOPE OF THIS PUBLICATION

*This publication provides information about stakeholders, legal initiatives and measures that contribute to the high level of air quality in Germany. As traffic is a main contributor to air pollution, special emphasis is given to what can be done to reduce pollutant emissions from the transport sector.*

*Chapter 1 outlines the legal framework conditions for clean air in Germany, which are derived from European Union legislation to a large extent. Chapter 2 describes how air pollution in Germany is tackled from a planning perspective. Chapter 3 shows exemplary measures and initiatives taken by municipalities, companies and environmental associations to reduce pollutant emissions in the transport sector. Chapter 4 provides information about technological solutions for reducing emissions. Chapter 5 covers selected examples of international cooperation for clean air.*

***Facts and Figures on Transport in Germany***

- *In 2018, more than 46.5 million cars were registered in Germany. This equals to 562 cars per 1,000 inhabitants.*
- *About 72 per cent of freight traffic volumes are carried on the road, followed by rail with a share of 17 per cent.*
- *Lorry toll rates in Germany vary between 0.08€ and 0.22€ per km depending on environmental performance.*
- *Greenhouse gas emissions in Germany declined from 1,250 million tonnes CO2 equivalent in 1990 to 909 million tonnes CO2 equivalent in 2016; greenhouse gas emissions from transport accounts for about 20 per cent.*
- *In Munster about 38 per cent of all trips are done by bike; the average in German urban areas is over 10 per cent.*
- *A single trip by public transport costs €2.80 in Berlin, €2.90 in Munich and €3.30 in Hamburg.*
- *Pollutant emissions from transport were reduced significantly in the last 20 years: carbon monoxide (CO) by 90 per cent, polycyclic aromatic hydrocarbons (PAH) by 90 per cent, benzene by more than 95 per cent, nitrogen oxides by 90 per cent and particulate matter by 70 per cent.*

# CLEAN AIR – MADE IN GERMANY

*According to the World Health Organization (WHO), 4.2 million premature deaths are caused every year by outdoor air pollution. If health effects of indoor air pollution are also taken into account, air pollution is the largest single environmental health risk on a global scale. Even though air pollution has its largest impact on human health in low- and middle income countries, particularly in South-East Asia, it is also a major health risk in industrialized regions. Calculations of the Federal Environment Agency of Germany show that exposure to fine particles causes about 47,000 premature deaths per year in Germany.*

*A considerable reduction of air pollution was achieved in recent decades in Germany. Today, we can see clear skies even over heavily industrialised regions and "Waldsterben" (a German expression for forest decline due to acidic air pollution, a word that has been borrowed in other languages), seems to be removed from everyday vocabulary. This example reminds us that mitigation of air pollution not only protects human health, but also ecosystems.*

*First of all, these successes were achieved by technologies like flue-gas desulfurisation, the use of electrostatic precipitators and catalytic converters. The application of these technologies was enforced by emission standards, which are now mainly implemented at European Union level and are subsequently transferred to national laws and ordinances. These emission standards are mostly aimed at specific plants or motorised vehicles, like large combustion plants or diesel passenger cars. However, a successful air quality policy cannot be based only on emission standards.*

*Once released to the atmosphere, emitted pollutants are dispersed in the air and may react with other air constituents to form secondary air pollutants. Emission levels can only serve as proxies for ambient concentrations of air pollutants, which are directly linked to health outcomes. Therefore, it is also important to directly regulate ambient concentrations of air pollutants. In Germany, the responsibility to meet air quality levels enables local and regional authorities to set up air quality plans containing various measures to improve air quality. Well-known examples for local measures are Low Emission Zones, which exclude vehicles without low emission standards from areas within the zone.*

*Since air pollutants can be transported over long distances, it is also necessary to cooperate on an international level. The Convention on Long-range Transboundary Air Pollution is an example of how states can cooperate to reduce air pollution. Commitments not to emit more than a given total amount of a pollutant are instruments that can be used within these international conventions.*

*Although a lot has been done to improve air quality in Germany, we still have a long way to go to meet the NO2 (nitrogen dioxide) limit value and the WHO recommendation for PM10 (particulate matter). Beside the reduction of emissions from classical sectors like traffic and industrial plants, several other fields of action have been identified. These include the reduction of particle emissions from non-road mobile machinery and domestic wood combustion as well as the reduction of ammonia emissions from agriculture. Air quality improvement is not only an important task for developing countries, but still remains a huge challenge for the industrialised world.*

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***Text by the Federal Environment Agency (Umweltbundesamt).***

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***For more information please refer to:***
*www.umweltbundesamt.de/en*

Umwelt Bundesamt

# 01.
# Policies for Healthy Environments

## CLEAN AIR REQUIRES SOUND LEGAL FRAMEWORK CONDITIONS

*Air pollution is caused by human activities. Energy consumption, road transport, agriculture and the production of goods are the main sources. Of all air pollutants, particulate matter and nitrogen dioxide affect human health the most. Stringent limit values and measures to prevent emissions from industry, transport and private households have helped to significantly decrease air pollution in Germany compared to previous decades. However, concentrations of particulate matter and nitrogen oxides still exceed current limit values. Some particulate matter in the air is caused by the conversion of gaseous air pollutants such as sulphur dioxide, nitrogen oxides, volatile organic compounds and ammonia. These air pollutants also damage ecosystems and their biological diversity and lead to higher ozone concentrations, which are detrimental to human health.*

## 1.1 THE GERMAN GOVERNMENT'S POLICY

*Germany is well on the way to meeting the standards for air pollution control set by the European Union. For sulphur dioxide and volatile organic compounds (from solvents, for example) it is sufficient to apply the measures already adopted and implemented in the past. Additional reductions are required, however, for nitrogen oxides and ammonia. The necessary reductions in nitrogen oxide emissions will be achieved in the transport sector and in stationary installations. The reduction in ammonia emissions will be achieved by the continued stringent implementation of the German government's programme for the reduction of ammonia emissions from agriculture.*

***The German government bases air pollution control on four strategies:***

- → *laying down environmental quality standard*
- → *emission reduction requirements according to the best available technology*
- → *product regulations*
- → *setting emission ceilings*

*Limit values are increasingly stipulated in European air pollution control directives, which are then transposed into German law. Important European directives include, for example, Directive 2008/50/EC on ambient air quality and cleaner air for Europe, the future directive on industrial emissions and Directive 2001/81/EC on national emission ceilings for certain atmospheric pollutants.*

*Pollutant Measuring Point Waldhof*

## 1.2 IMPORTANT POLICY INSTRUMENTS FOR CLEAN AIR

***Federal Immission Control Act and Implementing Ordinances***
*Air quality control in Germany is mainly governed by the Act on the Prevention of Harmful Effects on the Environment Caused by Air Pollution, Noise, Vibration and Similar Phenomena, (the Federal Emission Control Act (BImSchG) for short) and its implementing ordinances and administrative regulations. In addition, there are also provisions on air quality control at Federal State levels.*

***Technical Instructions on Air Quality Control (TA Luft)***
*The Technical Instructions on Air Quality Control (TA Luft) are a modern instrument for German authorities to control air pollution. They contain provisions to protect citizens from unacceptably high pollutant emissions from installations as well as requirements to prevent adverse effects on the environment. In addition, it sets emissions limit values for relevant air pollutants from installations. Existing installations must also be upgraded to the best available technology.*

***Amendment to Ordinance on Small Firing Installations (1. BImSchV)***
*The amendment to the Ordinance on Small Firing Installations (1. BImSchV), which entered into force in March 2010, was an important step towards reducing particulate matter emissions from small firing installations such as stoves and tiled stoves. The amended requirements for new installations and the modernisation of existing installations will achieve a noticeable reduction in particulate matter emissions, averaging 5 to 10 % in the residential areas concerned.*

***Implementation of the directive on industrial emissions***
*A large share of the emissions reduction necessary to meet the targets above will be achieved by the implementation of the directive on industrial emissions.*

***Transboundary air pollution control policy***
*A significant share of the pollution load is transported through the air over long distances from neighbouring countries. For this reason, shaping a transboundary air pollution control policy is of strategic importance for air quality in Germany. The German government is actively involved in a constructive dialogue on air pollution control measures both at European and international level. One example of this is the cooperation with the Geneva Convention on Long-range Transboundary Air Pollution.*

***For more information please refer to:***
*www.bmub.bund.de/en/topics/air-mobility-noise/air-pollution-control/general-information*

## 1.3 VEHICLE EMISSION STANDARDS IN GERMANY AND THE EU

*Transport accounts for 32% of greenhouse gas (GHG) emissions in the EU. In 2017, the European Commission (EC) published its regulatory proposal for post-2020 carbon dioxide (CO2) targets for new cars and vans. The proposed regulation would be the third set of mandatory vehicle CO2 performance standards in the EU. The first set, implemented in 2009 after a voluntary commitment by the auto industry to reduce average vehicle CO2 emissions had failed to produce adequate results, established average targets of 130 grams per kilometer (g/km) for new cars in 2015 and 175 g/km for vans in 2017. Vehicle manufacturers met both targets several years in advance. A second set of regulations, passed in 2014, required average CO2 emissions of new cars and vans to fall to 95 g/km by 2021 and 147 g/km by 2020, respectively (Figure 1). The proposed regulation for cars and vans sets targets for 2025 and 2030 and includes provisions aimed at promoting the uptake of zero emission vehicles and improving real-world CO2 compliance. In 2018, the EC also published its regulatory proposal for its first-ever CO2 standards for heavy-duty vehicles. If finalized, the EU would become the sixth major market to regulate CO2 emissions from trucks. The final targets for both EC proposals depend on the outcomes of political negotiations between the European Parliament and the European Council.*

*Air pollutants from vehicles have been regulated in the EU since the 1970s, but the current form of regulation—the well-known "Euro" standards—dates to 1992. The latest standards, Euro VI (2013, for heavy-duty vehicle engines) and Euro 6 (2014, for light-duty vehicles) set emission limits for carbon monoxide (CO), hydrocarbons (HC), nitrogen oxides (NOx), and particulates. The limits have tightened considerably over the years. For example, NOx emission limits for diesel passenger cars were reduced by about 70% from Euro 4 to Euro 6. However, on-road data have shown that real-world NOx emissions from diesel vehicles did not decline as much as emissions produced in vehicle tests under laboratory conditions (Figure 2). To improve real-world emissions compliance, the EU has introduced a series of changes to its type approval framework and test procedures. European regulation has a profound impact on vehicle emission standards globally, as most vehicle markets follow the Euro-regulation pathway.*

***Text by International Council on Clean Transportation.***

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***For more information please refer to:***

- *www.theicct.org/europe*
- *transportpolicy.net/index.php?title=Category:European_Union*

icct
THE INTERNATIONAL COUNCIL ON CLEAN TRANSPORTATION

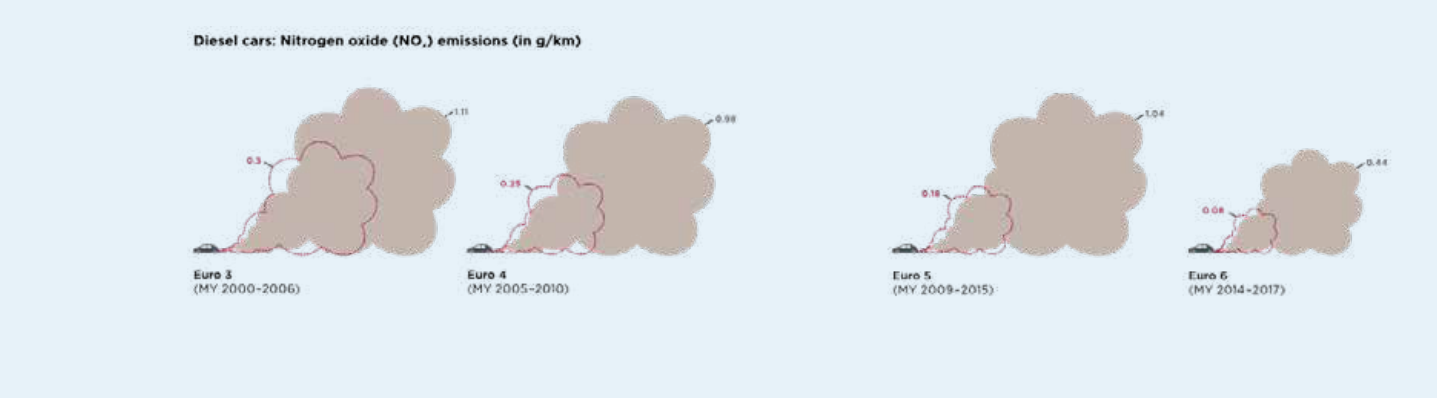



***Figure 1. Nitrogen oxide (NOx) emissions (limits vs. on-road measured values) for diesel cars in the EU***
***Source:*** *https://www.theicct.org/publications/ec-proposal-post-2020-co2-targets-briefing-20180109*

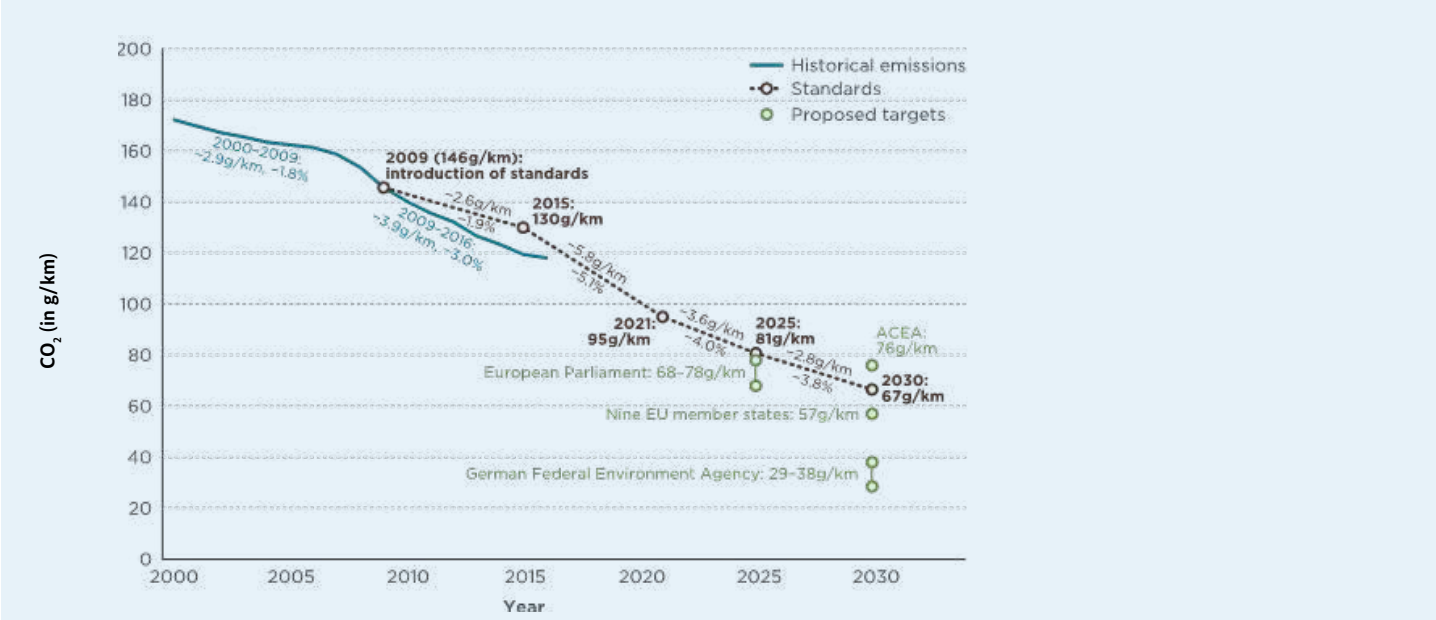



***Figure 2.*** *Average CO2 emission values, standards, and proposed targets for European passenger cars.*
***Source:*** *https://www.theicct.org/publications/ec-proposal-post-2020-co2-targets-briefing-20180109*

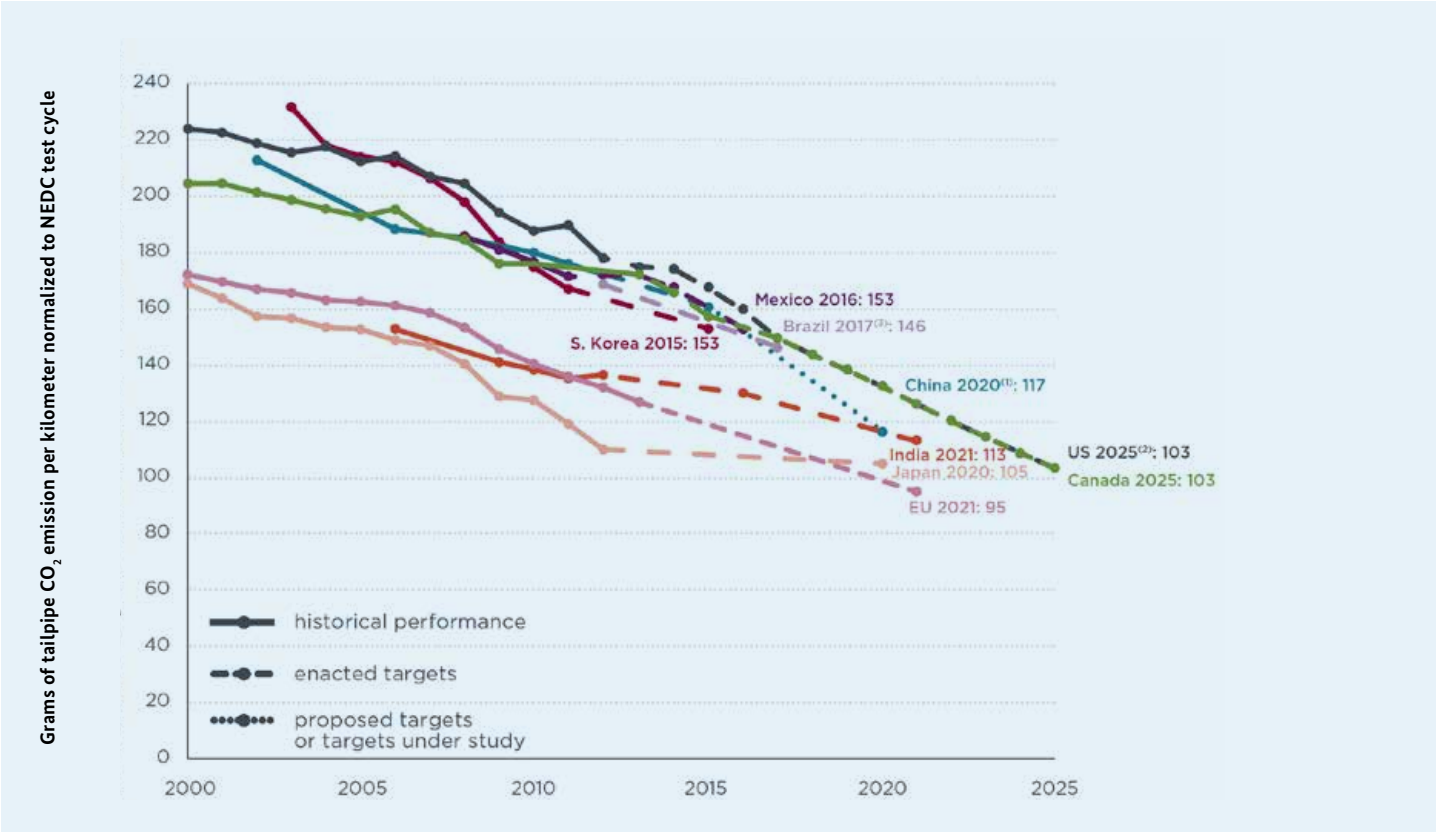



***Figure 3.*** *Comparison of global $CO_2$ regulations for new passenger cars.*
***Source:*** *www.theicct.org/info-tools/global-passenger-vehicle-standards*

# *Interview with Axel Friedrich:* ***Improving Air Quality – the German Experience***

***Q: What has been achieved in Germany?***

***A:*** *Air quality in German cities is as high as the air quality was in rural areas 20 years ago. We reduced carbon monoxide (CO) by 90 per cent, polycyclic aromatic hydrocarbons (PAH) by 90 per cent, benzene by more than 95 per cent, nitrogen oxides by 90 per cent and particulate matter by 70 per cent. This means we achieved a massive reduction of air pollution in Germany.*

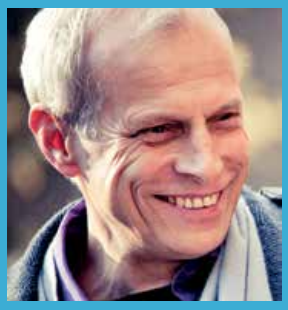
***Q: How the problem of air pollution was approached?***

***A:*** *We started in different ways. First of all, exhaust regulations in the transport sector and the use of particle filters in cars and trucks led to decreasing concentrations of benzene and ozone. Second, legal initiatives from the European Union - driven by persistent air quality problems - enforced strict regulations for industrial facilities. The problem was approached from the planning side as well as through legislation for achieving quick and significant improvements. Laws were useful, but so were economic incentives to spread the application of appropriate measures.*

***Q: What were success factors and what didn't work out so well?***

***A:*** *Crucial success factors were the engagement of the Federal Environmental Agency (UBA) and a number of environmental associations. They kept up high political pressure and also informed the public about the problem, while possible solutions were outlined and communicated. Many of these initiatives had their origin in the UBA, highlighting the fact that an effective environmental administration needs to be in place that is also able to enforce the right measures.*
*At the same time, private businesses were not always eager to cooperate. They tried to block stricter regulations with the argument of higher costs. A negative aspect is that better air quality is not for free. But the damages are way more expensive than the costs for reducing emissions. These costs are carried by the entire society, while the mitigation costs come first hand to the entrepreneur. But it has proven that stricter regulations are an important driver for innovation and thus can benefit the economy.*

## DR.-ING. AXEL FRIEDRICH



*Dr.-Ing. Axel Friedrich is Technical Chemist from the Technical University of Berlin and worked for more than 28 years with the Federal Environment Agency of Germany (Umweltbundesamt, UBA). From 1994 to 2008 he headed the division "Environment and Transport, Noise", dealing with all transport related environmental issues, including air pollution, noise and planning. Since 2008, Axel Friedrich works as a consultant for the World Bank, GIZ, ADB and other international organisations in a number of middle income and developing countries, including China, India, Indonesia, Thailand, Malaysia, Chile, Mexico and Brazil.*

*In Europe, he was involved in the rulemaking process for the emissions standards for cars, trucks and fuels. He was the former Chairman of the OECD working group on transport, as well as a former member of the Committee of the German Transport Ministry for the implementation of the National Bicycle Plan. He is a member of the Advisory Committee of the German Bicycle Academy and member of the scientific advisory committee of the VCD (Verkehrsclub Deutschland) as well as a founding member of ICCT (International Council for Clean Transport).*

*Axel Friedrich was granted with the Haagen Smits Clean Air Award in 2006.*

***Q: What are the remaining challenges and priorities for Germany?***

***A:*** *The core topics are still around climate change; in this area we still have a lot to do with regard to the further reduction of CO2 as well as the short-term climate factors like black carbon, soot, fluorocarbon or methane. Current proposals are by far not enough to meet the needs.*
*We also have a huge problem with a high concentration of nitrogen dioxide (NO2) which is caused mainly by diesel cars due to cheating of the industry. Measurement by monitoring stations show, that pollution limits are regularly violated, so additional measures have to be taken. A big challenge is how to enforce all of this legislation. Legislation is only as good as enforcement is. What we have seen in the Dieselgate is that we need good enforcement.*
*We are now fighting on EU-level for better legislation on emission tests as well as to retrofit diesel cars with hardware and SCR systems, which as we have shown, can reduce the concentration of emissions from 1000 micrograms down to below 50 micrograms.*

***Q: How did you understand the Dieselgate decision of the German Court?***

***A:*** *It is clear that our constitution requires protection of the human health. Therefore, the court has agreed that the standards of the EU have to be met. Most of the European cities violate these standards due to the high emission of diesel cars. In many cases, there were no other options than to ban old diesel cars. We have done this before for diesel cars with high particulate emissions and this was very successful. Thus, the rule of the German Administration Court is a chance to ban highly polluting diesel cars.*

***Q: What can developing countries and emerging economies learn from the German experience?***

***A:*** *The most important step before introducing rules is to create clarity about the problem. This means an emission inventory should be established to assess where the problems actually come from. This should be combined with an effective air quality monitoring system to generate the necessary information for being able to assess the most cost-efficient measures to reduce human health and climate impacts. Next to monitoring, education of the public and political sphere is also a very important factor.*

***THANK YOUR VERY MUCH!***

## 1.4 THE RIGHT FOR CLEAN AIR

*Clean air is essential to good health and is a basic human need. EU policy has recognized this need, providing legal protection through directives and court judgments. The Ambient Air Quality Directive sets legally binding limits on levels of ambient air pollution. However, even the European Court of auditors has just recently reported, that our health is still insufficiently protected. Failure to comply with the directive is widespread throughout the EU: limits are frequently breached in many regions and cities, air quality plans are often late, inadequate, not properly implemented, or simply non-existent, current limit values do not reflect latest findings on health effects and economic costs.*

*Based on several EU laws, every citizen has a "right for clean air" and can force competent authorities to initiate measures to lower air pollution. After relevant court decisions in the past, the access to court for NGOs in air quality cases reflecting EU law has been improved but does not comply with the requirements of the Aarhus Convention systematically.*
*The Deutsche Umwelthilfe (DUH, German Environmental Aid) has initiated several court cases in the last years in order to achieve concrete and effective measures to lower air pollution in cities. Up to now, every single case has been successful.*
*In February 2018, the highest Administrative Court in Germany confirmed that bans for diesel vehicles as major source for high NO2 concentration are feasible and appropriate to achieve compliance with the standards as soon as possible.*
*Together with our partner Client Earth, DUH published a clean air handbook, summarizing basic legal information and background material. It informs and empowers private citizens and NGOs to realize their right to clean air in the frame of LIFE + project "Right to Clean Air".*

*DUH also is active in elucidating the diesel exhaust scandal in Germany and provides own exhaust gas measurements for passenger cars while driving on the road. We also activate citizens to measure NO2 concentration in their hometown.*

***Text by the Deutsche Umwelthilfe (German Environmental Aid, DUH).***

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***For more information please refer to:***
*https://www.right-to-clean-air.eu/*
*https://www.duh.de/englisch/*
*https://www.duh.de/projekte/eki-kontrollen/eki-ergebnisse/*
*(German Language)*

Deutsche Umwelthilfe

### *The Clean Air Handbook – A practical guide to EU air quality law*

*Clean air is essential to good health and is a basic human need. EU law has recognised this need, providing legal protection through directives and court judgments. This practical guide to EU air quality is designed to help people exercise their right to clean air.*

***Download:*** https://www.documents.clientearth.org/wp-content/uploads/library/2015-11-30-clean-air-handbook-version-two-ce-en.pdf

# 02. Clean Air Management

## CLEAN AIR CAN BE PLANNED

*Sustainable transport measures can reduce the concentration of air pollutants, even if emissions are not the primary target. These include measures in urban areas like public transport improvements and vehicle upgrades, the implementation of pedestrian areas, bike and car sharing systems, 30-km/h zones and even street cleaning. Many of these measures are taken up in so-called Clean Air Plans, which are coordinated with overarching mobility planning processes.*

*This chapter outlines how air pollution is monitored and targeted by planning procedures in Germany. The measurement and modelling of air pollution as well as air quality planning at municipal levels are explored from administrational, technical-professional and municipal perspectives.*

*Measuring station at the Federal Environmental Agency.*

## 2.1 MEASUREMENT OF AIR POLLUTION

*Air-borne pollutants are often imperceptible to the human senses. They are invisible yet always present in moving air masses. Some air pollutants occur in such low concentrations that they do not have any effect on humans or the environment. With others it takes a long time until their effects are manifest.*

*In order to guarantee clean air for human beings and the environment, or to improve air quality where necessary, experts regularly carry out measurements across Germany. The air monitoring networks operated by the German Federal Environment Agency and Germany's Lander (federal states) fulfil different tasks. The air monitoring network of the Federal Environment Agency (Umweltbundesamt – UBA) operates measuring stations far away from densely populated areas and cities. Local sources of pollutants, such as industrial sites or power stations, should not affect the measurements. Situated in rural areas, the stations of the Federal Environment Agency measure the quality of air masses transported over long distances and across national borders.*

***Measurement of Local Air Pollution***
*Unlike the Federal Environment Agency, Germany's Lander operate measuring stations in cities, in conurbations, in areas with high traffic density as well as in rural regions, in order to monitor and determine local and regional air quality.*

***Current Pollution Situation***
*The Federal Environment Agency brings together the air quality data from its own network and those of the Lander's networks. These data are used to provide, for each measured pollutant, maps showing the current air quality situation in all of Germany. This information is updated continuously. Measuring values from individual stations with high air pollution levels are made available by the environment agencies of the Lander.*

***Information on Measuring Sites***
*Each air monitoring station in Germany (Federal or Lander) has a specific measuring programme and works with specific measuring instruments. Information both on stations currently in operation and on stations that are no longer operational is available at the Federal Environment Agency's stations database.*

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***Text by Federal Environment Agency (Umweltbundesamt).***

***For more information please refer to:***
- *www.umweltbundesamt.de/en/topics/air/measuringobservingmonitoring*

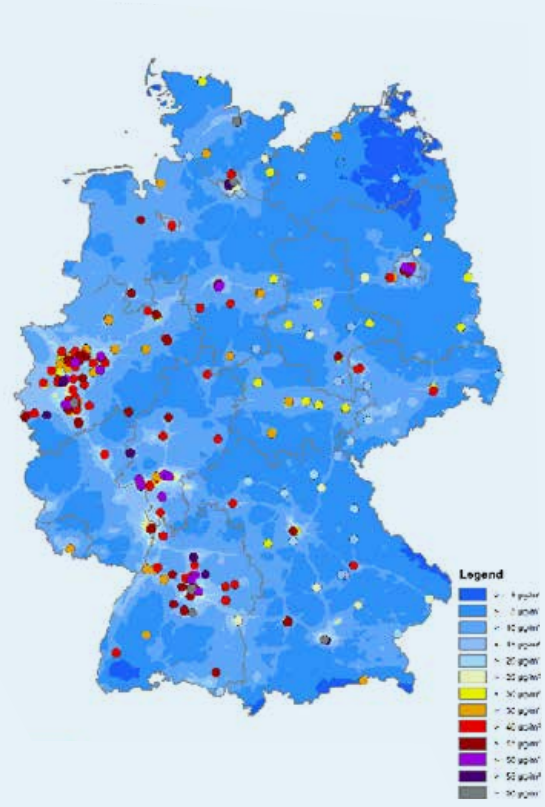
Umwelt Bundesamt

## 2.2 DATABASE: CURRENT CONCENTRATIONS OF AIR POLLUTANTS IN GERMANY

*The Federal Environment Agency and the environmental agencies of the Lander are responsible for monitoring air quality in Germany. Measuring stations of the Federal Environment Agency (UBA) and the German States record data several times a day on ambient air quality in Germany.*

***On this website you can get up-to-date information about air pollutant concentrations:***
*www.umweltbundesamt.de/en/data/current-concentrations-of-air-pollutants-in-germany*

***$NO_2$ – ANNUAL MEAN YEAR 2016***




***NUMBER OF DAYS WITH $PM_{10}$ DAILY MEAN VALUES IN EXCESS OF 50 µG/M³ YEAR 2016***


***Figure 4.*** *Source: Federal Environmental Agency*

## 2.3 LINKING EMISSIONS CALCULATION WITH TRANSPORT DEMAND DATA AT STREET LEVEL (HBEFA)

*The Handbook of Emission Factors for Road Transport (HBEFA) is a PC-supported database originally developed on behalf of the environmental protection agencies of Germany, Switzerland and Austria, but it is now used and supported by many other European countries. It presents emission factors per kilometre or driving situation depending on a vast number of parameters to choose from. The HBEFA offers several levels of differentiated output, e.g. (i) by type of emission("hot", cold, evaporative) and matching specific parameters; (ii) by vehicle category: passenger cars, heavy duty vehicles etc.; (iii) by year and implicitly by varying fleet compositions for certain countries; (iv) by pollutants (regulated and unregulated); and it also gives the option of weighted emission factors (per vehicle category, per concept, per fuel type or per sub-segment i.e. engine size). Because it is impossible to cover that many options by measurements within reasonable time and financial constraints, a simulation tool named PHEM (Passenger car and Heavy duty vehicle Emission Model) was developed by TU Graz, which calculates the emission factors. Random measurements ensure the validity of the tool and its results. On-going projects are necessary to improve and extend PHEM (e.g. to include findingsfrom new technologies like Euro 6 exhaust gas after treatments (DOC, DPF, SCR)). Many different institutions use the HBEFA – including federal agencies and state governments, research institutions and environmental consultancies – to estimate future air quality and to compare the impact of different measures regarding traffic and transport.*

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***Text by Federal Environment Agency (Umweltbundesamt).***

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***For more information please refer to:***
*www.hbefa.net/e/index.html*

Umwelt Bundesamt

## 2.4 MODELLING AIR POLLUTANT AND GREENHOUSE GAS EMISSIONS

*The transport of persons and goods is one of the major sources of air pollution and carbon dioxide emissions. Strategies and individual measures in transport have to be assessed in terms of their mitigation potential to reduce both dangerous local emissions of toxic pollutants like NOx and particles and global emission of CO2. Measuring transport emissions on a large scale has long been seen as a nearly impossible exercise, and therefore rough estimations have been used to evaluate the impact of certain measures on emissions.*

*Transport planning offers solutions for this dilemma, as transport modelling can be used as an adequate basis to model emissions and evaluate the impact of mitigation measures. Based on the output of traffic modelling software such as VISUM and VISSIM (PTV Planung Transport Verkehr AG), internal or external emission models can calculate emissions of the most important air pollutants and greenhouse gases both on a local (road section, intersection) and a system level (whole networks, such as an urban transport system).*

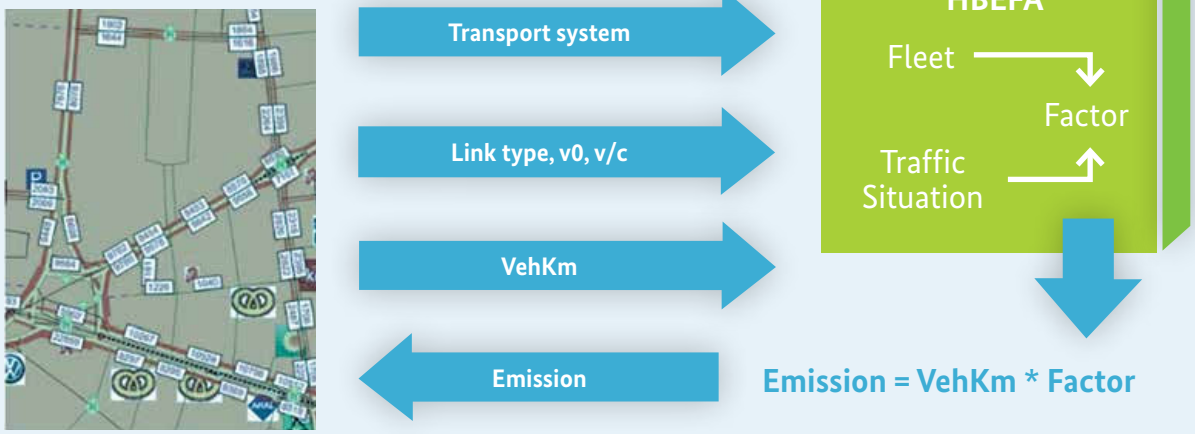


***Figure 5.*** *Air pollutant and greenhouse gas emissions modelling (simplified). Source: PTV AG*

*On a macroscopic level (software models such as VISUM or IMMISem), emissions are simulated based on the handbook of emission factors (HBEFA, refer to section 2.3). The emission levels of specific vehicle types under different operation and traffic situations is employed by coupling this information with traffic conditions, traffic flows and fleet information. Thus, emissions can be calculated reliably and the impacts on local environments can be evaluated properly, by using the emissions as input for dispersion models (refer to section 2.5).*

*On a microscopic level (in microscopic simulation, e. g. using PTV VISSIM) emissions are evaluated based on the simulation of single vehicles, using related measurements for vehicles under the different operation modes. Thus, modelling is a powerful tool to design transport measures and strategies in order to reduce air pollutant and GHG emissions, and provide valuable information for planning and sound decision-making. One example for the application of these tools is the modelling of the impact of traffic control strategies. Such tools are developed to minimise pollutant concentrations by regulating traffic flows in the City of Munich (Program for environmental oriented traffic management). The model has been used to evaluate the impact of changed traffic control programs in the network – from the traffic side as well as the basis for detailed environmental assessment. This was done in close cooperation with IVU Umwelt GmbH, which also modelled and evaluated the concentrations (refer to section 2.5).*

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## *Text by PTV Group.*

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*www.ptvgroup.com*

PTV GROUP
the mind of movement

## 2.5 MODELLING AIR POLLUTANT CONCENTRATION LEVELS

*Quantifying emissions is essential for reporting, and for impact assessments of different air quality strategies. To protect human health and the environment, it is important to know the pollution concentrations people and the environment are exposed to. Emissions affect these concentration levels, but they also strongly depend on meteorological and environmental conditions; both determine the transmission, i.e. the transport and possible transformation of substances, from the emission sources to the receptors. Measurements and modelling both are used to quantify these concentration levels (see chapters 2.1–2.4), which are regulated by limit values.*

*Measurements of pollutant concentrations are expensive and time-consuming and so monitoring stations are typically set up for singular locations, not for entire areas or cities. In addition, as measuring is possible only for existing situations, it cannot be used to assess future scenarios.*

*Dispersion modelling, on the other hand, does not have these limitations and can deliver assessments for entire areas in high spatial resolution as well as for future developments. Based on emission data (see sections 2.1-2.2), dispersion modellingsimulates the physical and chemical transport- and transformation-processes and calculates concentration levels for arbitrary locations and points in time. Depending on the aim of the modelling study and its spatial scope, different models or combinations thereof are employed. Operational modelling systems exist for all relevant spatial scales, ranging from continents or countries (e. g. RCG) down to specific street sections or crossroads (e. g. IMMIS), and are being routinely used by universities and private environmental consulting companies.*

*For example, so-called screening-models (such as IMMISluft) allow the identification of highly affected areas or "hot spots" and can assess the population's exposure for entire cities. A complete modelling chain with RCG and IMMIS has been applied (e.g. Berlin). Such an exhaustive assessment is a valuable basis for air quality planning and prioritising measures(see, in German, www.stadtentwicklung.berlin.de/umwelt/luftqualitaet/de/luftreinhalteplan/download.shtml).*

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### *Text by IVU Umwelt GmbH.*

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***For more information please refer to:***
*www.ivu-umwelt.de*

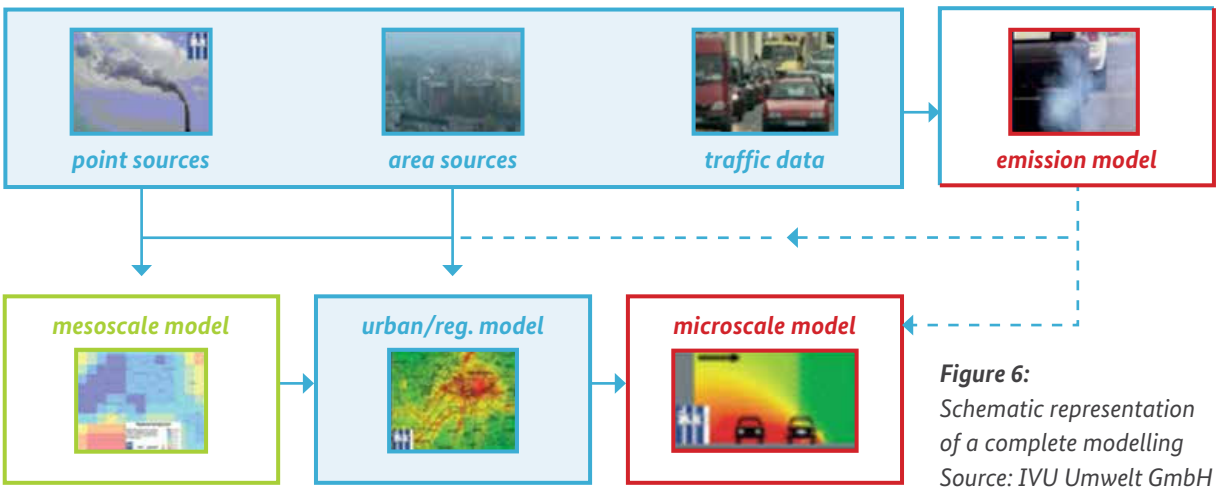


***Figure 6:***
*Schematic representation of a complete modelling*
*Source: IVU Umwelt GmbH*

## 2.6 AIR QUALITY PLANS: PLANNING FOR CLEAN AIR IN CITIES

*Clean air in German cities can be partly ascribed to a planning process on the municipal level reaching back several decades. Nowadays the focus is on municipal air quality plans which have to be compiled in all cities which exceed threshold values. In large cities, the air quality plan is prepared by the municipality and the process is supervised and controlled by the state environmental agency. The legal framework is defined by European and national legislation. A municipal air quality plan comprises all emissions sources like transport, industry, power generation and households. Based on emission and exposure models of the two main pollutants PM and NO2, air quality levels are calculated. The transport sector usually contributes a large share of the total emissions.*

*Since the introduction of the municipal air quality plans, many municipalities expected major progress by tightened emission standards as part of the improved vehicle technology. This hope on cleaner air without any local planning measures turned out to be an illusion when the (Volkswagen) Diesel Emissions Scandal became public. As predicted by some experts, it was proven that vehicles built by a wide range of car makers worldwide cheat systematically on government emissions tests. Many new vehicles emit higher levels of pollution under real world driving conditions. Government institutions, politics and the general public began to realize that technological advancement on its own is not sufficient. Without additional measures the threshold values especially of NO2 cannot be met at monitoring stations close to high-capacity roads.*

*The additional measures interact with land-use planning and transportation planning. For a better air quality an improved spatial pattern with less urban sprawl, a multifunctional city with short travel distances and an alternative travel behavior of the inhabitants have the largest potential in the long term. In the short term, environmental zones, more attractive non-motorized modes, improved public transport service, less public transport emissions and a better traffic flow have positive effects. However, additional car traffic induced by a steadier and faster traffic flow generates new emissions. Therefore, the most important component is to make car transport less attractive by means of e.g. speed limits, driving restrictions, parking management and pricing schemes.*

*While preparing the air quality plan every five years, intensive public consultation has to take place. Before a plan comes into effect, the city council has to agree on it. Although this democratic participation is positive, the actual effect of the air quality plan used to be very limited in many municipalities. Measures stated in the plan were never implemented and other city council decisions were even contradicting to the plan. In combination with the unchanged vehicle emissions due to the Diesel Emissions Scandal, the exposure of the urban society to PM and NO2 remained constant. Since politics and public administration failed to achieve progress in air quality management, environmental NGO's started to sue the government to fulfill the air quality standards defined by EU legislation. Those lawsuits against 28 municipalities in 2018 increased the pressure to act tremendously since the courts may order tight restrictions on car transport judicially.*

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***Technical University of Dresden, Faculty of Transportation and Traffic Sciences, Chair for Transportation Ecology.***

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*Dr. Thilo Becker, thilo.becker@tu-dresden.de*
*Prof. Dr. Udo Becker, www.verkehrsoekologie.de*

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www.tu-dresden.de

TECHNISCHE UNIVERSITÄT DRESDEN

## *Consultation of Stakeholders and the Public when Developing Berlin's Air Quality Plan*

*Following European and international legal obligations, Berlin's draft air quality plan was published on the web and the public was invited to comment over a two-month period. In 2004, more than 130 interventions were received, most of them dealing with the core measure – a low emission zone – which would prevent polluting vehicles from driving into Berlin's central area. After assessing these comments, a public hearing was held and the draft was amended before being adopted by Berlin's government.*

*Beyond that obligation, there is a long tradition in Berlin to involve other relevant institutions, bodies and associations at an early drafting stage in order to avoid troubles during the final adoption process. Involvement of affected groups in civil society – especially environmental NGOs and businesses associations – during or even after the adoption of the strategy often facilitated the implementation of the measures later on, enhancing mutual understanding for the planned action to reduce pollutant emissions. Stakeholders and industry federations can also be a useful source of information on feasibility, costs and socio-economic impacts of potential measures. This was particularly important for framing details, like the timing and stringency of the low emission zone.*

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## *Text by Senate Department for the Environment, Transport and Climate Protection of the city of Berlin, Air Quality Management*

***Contact:***
*Martin Lutz, Martin.Lutz@senuvk.berlin.de*

***For more information please refer to:***
*Air Quality Plan for Berlin 2011-2017:*
***Download:*** *https://www.berlin.de/senuvk/umwelt/luftqualitaet/de/luftreinhalteplan/download/lrp_150310_en.pdf*
*https://www.berlin.de/senuvk/verkehr/mobilitaetsgesetz/index_en.shtml*

# 03.
# Taking Action

## EFFECTIVE MEASURES FOR BETTER AIR QUALITY IN CITIES

*Limit values on particulate matter have been in effect in EU law since 1 January 2005. A yearly average of 40 micrograms per cubic metre (µg/m3) and a daily average of 50 µg/m3 have been set for particulate matter smaller than 10 micrometres (PM10). The daily average may not be exceeded on more than 35 days per calendar year. Many German cities have recorded a significantly higher rate of exceeding the limit.*

*Since vehicle traffic is a major factor contributing to air pollution by particulate matter in urban areas, a number of Germany's cities have designated low emission zones (LEZ) whose purpose is to improve the air quality within these zones and thus protect public health. But they represent only one measure that is implemented by municipalities, private business and civil society to improve air quality in urban regions. The following section presents numerous effective measures for improving air quality.*

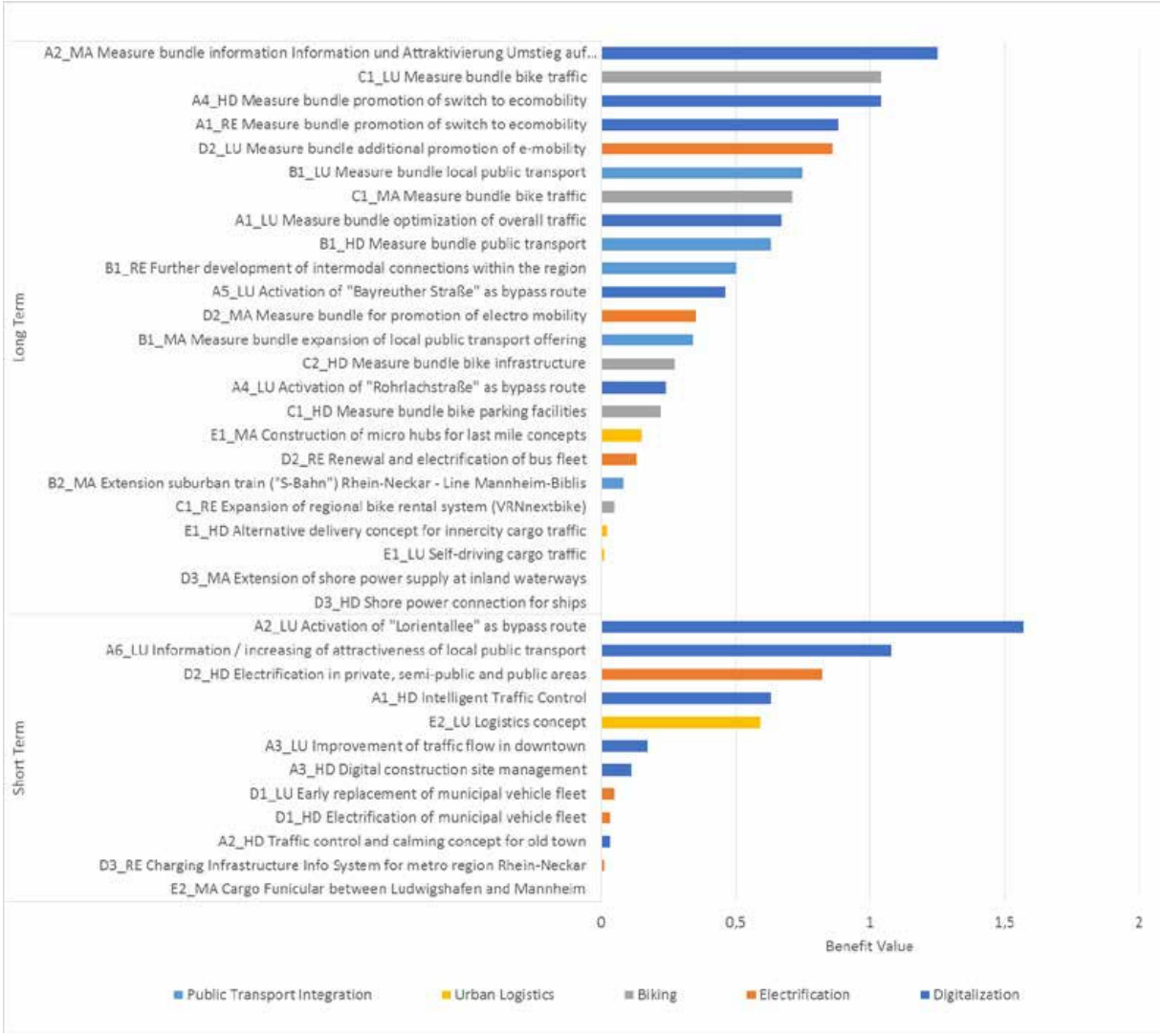
***For more information please refer to:*** http://cleanaireurope.com/en/

## 3.1 SYNERGIES FOR SUSTAINABLE MOBILITY BY JOINING FORCES ACROSS CITIES – CREATING A JOINT MASTERPLAN FOR HEIDELBERG, LUDWIGSHAFEN AND MANNHEIM


*For several years sustainable mobility has been a current topic for German cities, and been addressed by a multitude of air quality plans. As many cities face the threat of driving bans due to ongoing transgression of pollution limits, the urgency rises to create sustainable solutions that are both environmentally friendly and fulfill mobility requirements of city residents and commuters alike.*

*Ensuing Germany's „Dieselgipfel" (diesel summit) in 2017, the federal government established the fund "Nachhaltige Mobilität für die Stadt" (sustainable mobility for the city), supporting cities to create their individual masterplans. For the three cities of Heidelberg, Ludwigshafen and Mannheim, a specific challenge was involved: Their close vicinity, entwined commuter connections and shared public transportation systems mean that a masterplan was needed that goes beyond individual city limits. This allows better sharing of learnings, helps to avoid redundant investments and ensures a consistent, integrated portfolio of measures.*
*The integration of individual masterplans into a joint masterplan creates synergies but also significantly increases the need for coordination and drives complexity. Besides managing the editorial process, DB Engineering & Consulting supported the cities to formulate a common vision for sustainable mobility and define prioritization metrics to assess the contribution of each measure to the vision and meeting of environmental standards. Top level goals were primarily the reduction of NOX immissions, with components oriented toward short term as well as long term effects. More than 120 measures were scoped, bundled and had to be prioritized based on a uniform as well as flexible assessment framework.*

*The following figure illustrates the ranking by benefit value on the level of measure bundles across all cities. The scope of each measure bundle regarding a city or the region is indicated by '_RE_' within the measure name for the region, or '_MA_' for Mannheim, '_LU_' for Ludwigshafen, and '_HD_' for Heidelberg.*




*Five focus areas emerged from the measure portfolio of the masterplan:*

- *Increase attractiveness of public transport and thus reduce individual motorized traffic, e.g. with digitally enabled bike lockers, park & ride facilities, multimodal mobility stations, extending ride pooling offers etc.*
- *Deployment of low emission motor technologies (e.g. hybrid, electric, fuel cells), e.g. by electrifying the public bus fleet and rollout of charging infrastructure*
- *Increase fluidity of remaining traffic to lower pollution emissions, e.g. by changes in feeder routes and updating of signaling systems*
- *Improve freight traffic through intelligent staggering and bundling of transports to decrease the number of trips as well as the emission per transport, e.g. by creation of micro hubs for sustainable last mile delivery*
- *Digitalization – with direct contribution, e.g. managing traffic flows with intelligent traffic light systems; as well as with indirect effects by increasing attractiveness of public transport, by real time information on availability of intermodal transport, current travel times, availability of park & ride facilities etc.*

*In addition to the benefit contribution of each measure a cost estimate was taken into account for the prioritization ranking. Bundling and assessment of measures ran simultaneously to their detailing, cost estimation and alignment between different constituents. Therefore, the project used a collaboration website for content management as well as automatic consolidation of assessments and calculation of priority rankings. This also gave participants instant access to all current measure definitions and rankings based on the current state of the project.*

*Beside the joint masterplan itself the collaborative approach across cities had additional positive effects: "The ongoing exchange of information between everyone involved has improved. It strengthened the sense of community among the participants beyond existing shared institutions for public transport operation. Now, we know better how well we can rely upon each other", rejoiced Alexander Thewalt, Director of the Heidelberg Traffic Management Office and key representative in the project for the city of Heidelberg. The project participants will keep on meeting regularly, in order to further advance their common program for sustainable mobility in the whole metropolitan region.*

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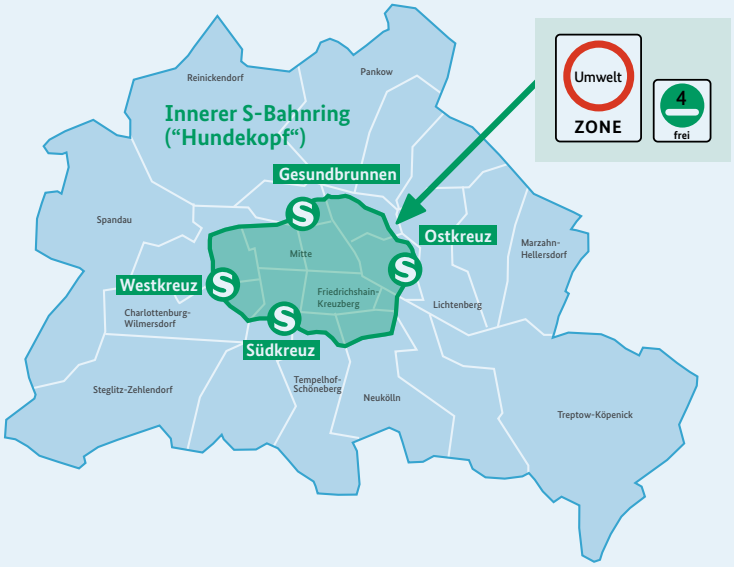
## *Text by DB Engineering &Consulting GmbH*

***Contact:***
*Florian Ohly – Florian.Ohly@deutschebahn.com*

***For more information please refer to:***
*https://ww1.heidelberg.de/buergerinfo/vo0050.asp?__kvonr=25934 (in German)*

***Figure 7:*** *Low emission zone inside the S-Bahn ring in Berlin*

***Source:*** *Senate Department for Urban Development and the Environment (2013):*
*www.stadtentwicklung.berlin.de/umwelt/luftqualitaet/umweltzone/de/gebiet.shtml*




## 3.2 LOW EMISSION ZONES IN GERMANY – THE BERLIN EXAMPLE

*Driving a car produces emissions: air pollutants, climate-damaging gases and noise. Of course, modern cars produce fewer emissions than older ones, so thankfully the days of Berlin smog alarms are long gone – the last alarm in West Berlin was in 1985. The modernisation of Berlin's industry and household heating systems has also made a major contribution to reducing atmospheric pollution.*

*The EU has set stringent limit values for these pollutants and threatens countries with and financial fines for breaching them. However, these are still being exceeded in Berlin, which is why the city has introduced a 'low emission zone'. A low emission zone is a defined urban area in which limit values are often exceeded and where only low-emission vehicles can be driven. In Berlin this is the area within the city rail ring, home to just over a million people. Contraventions incur a fine, currently set at €80. Federal law defines four categories ranging from slightly lower emission to ultra-low emission vehicle. Vehicles receive a windscreen sticker in different colours to show which category they belong to. It is at the discretion of the local authorities to decide, on the basis of local pollution conditions, which category of vehicle should be prohibited from entering the low emission zone and which exemptions may be granted.*

*Berlin emission zone is a defined urban area since January 1, 2008, as there was no other obvious way of quickly achieving a sufficient reduction in air pollution levels. Motor vehicles in Berlin are still major contributors to particulate pollution and are almost solely responsible for nitrogen oxide pollution. The low emission zone was introduced in two phases to give owners time to retrofit their vehicles or buy new ones. Initially vehicles with the highest emissions were prohibited, and the other three categories – red, yellow and green – were still allowed to enter the low emission zone. The second phase began on January 1, 2010. Since then, only vehicles that have a green sticker, i.e. the cleanest category of vehicles at present, are allowed within the zone. Continual monitoring of air quality has shown that the introduction of the low emission zone has been effective: it has significantly speeded up the replacement of old vehicles by low-emission ones. This has meant that particulate emissions are 50% lower than the predicted trend and nitrogen dioxide emissions are 20% lower. Despite this success, low emission zones, which have now also been introduced in over 300 other European cities and agglomerations, are the subject of heated public debate. Nevertheless, the fact that limit values are still being exceeded means that low emission zones remain a necessity. Other transport policies designed to further lower the percentage of motor traffic in the city's overall traffic volume promise to reduce pollution further.*

***Text:*** *Sustainable Urban Transport Project (SUTP): The Sustainable Urban Transport Guide Germany – Discover Berlin by Sustainable Transport:* https://www.german-sustainable-mobility.de/wp-content/uploads/2015/01/giz_TravelGuide_Berlin_Online.pdf

***Contact:*** sutp@sutp.org

## *European City Ranking – Berlin's efforts get noticed*

*What measures have been designed and implemented in some of Europe's most polluted cities? The European City Ranking of the initiative SOOT FREE FOR THE CLIMATE aims to answer this question and demonstrate that local solutions to reduce air pollution exist. It identifies which cities are best at it, and what others can learn from them.*


***Figure 8:*** *European City Ranking.* ***Source:*** www.sootfreecities.eu/


## 3.3 CAMPAIGN: GO BIKING! SAVE THE CLIMATE

*In 2006, the Ecological Transport Club Germany (Verkehrsclub Deutschland, VCD) has initiated the campaign „FahrRad! Fürs Klima auf Tour" (Go Biking! Save the Climate) and since then it has been taking place on a yearly base, reaching over 61,000 teenagers so far all over Germany. The main goal is that young people between the age of 12 and 18 years ride their bikes rather than being chauffeured by their parents via car.*

*To reach the target group most easily, the concept has been set up as an internet based campaign. The main idea is that the participants write down each kilometer they cycle and then transfer the sum of kilometers onto the homepage via their account. These accumulated kilometers take them on a virtual tour through Germany and Europe, giving them possibilities to learn about the benefits of biking and to get to know the threats of global warming being caused by traffic. There are many chances to win prices along the way as well. For teachers and team leaders there is teaching material available dealing with the subject of biking and environmental issues.*

*To better illustrate how much CO2 is saved by the campaign, the accumulated „bike kilometers" are converted into the equivalent amount of CO2. The result so far: more than 1,719t CO2 (more than 12.279.0000 km) not polluting the environment. This is the amount of CO2 which 1,102 cars produce in one year. Furthermore, replacing car traffic by cycling is one of the most effective ways to improve urban air quality.*

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### *Text by Verkehrsclub Deutschland (German Transport Association, VCD)*

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***For more information please refer to:***
*www.klima-tour.de (German Language)*

VCD Verkehrsclub Deutschland

## 3.4 „STADTQUARTIER 4.0“ - HOW CAN SUSTAINABLE AND SUSTAINABLE LOGISTICS IN URBAN DISTRICTS OF THE FUTURE LOOK LIKE?

*From 01.02.2017 - 01.02.2020 the Berlin Holzmarkt Areal is to become a pilot example for urban spaces. The project focuses on the development of logistics systems with high application potential and good adaptability to other city districts. The challenges are the infrastructure, the integration into logistic systems and the cooperation between municipalities and companies, so that the forward-looking ideas can be implemented in a functional way.*
*The Federal Ministry of Education and Research fund the project based on the funding measure „Sustainable Transformation of Urban Spaces“.*

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***Text by LNC LogisticNetwork Consultants GmbH***

**Contact:** *Daniel Rybarczyk, dar@lnc-berlin.de*

***For more information please refer to:***
*https://www.emo-berlin.de/en/projects/urban-district-40/*

## 3.5 ASSESSING THE EFFECTIVENESS OF AIR QUALITY & TRANSPORT MEASURES

*In Germany, many measures to improve air quality have been implemented during the last years. Assessing their effectiveness, however, is not an easy task. Effects of almost all measures are small with respect to the total concentration, which itself shows a strong variability independent of the measures (e.g. due to varying meteorological conditions). Nevertheless, there are assessments available that are based on monitoring data, scenario modelling, or a combination of both approaches.*

***Focusing on four sample measures, the following reduction potentials can be expected:***

***Low Emission Zone (LEZ):***
*Reduction potentials to reduce concentration levels for LEZs highly depend on the level of access restriction. Evaluation studies of actual LEZ implemented in the years 2008–2011 result in reduction potentials of up to 10% for NO2 , 7% for PM10and 10% for PM2.5. A high reduction potential of up to 19% for soot (black carbon) is particularly mentioned. It has to be noted, that a LEZ's reduction potential decreases the later it is being implemented, as the fraction of the vehicle fleet that is banned decreases due to the general modernization of the vehicle fleet. Theoretical assessments of future scenarios, e. g. an intensified penetration of 50% of Euro-6/VI vehicles in the fleet in 2015 would lower annual mean values of the total NO2-concentration by up to 20%.*

***Environmental Traffic Management (ETM)***
*ETM denotes traffic management that also focuses on environmental aspects (please refer to section 2.4. for an example from the city of Munich). This is achieved with temporary dynamic measures that are tailored to the local pollution levels with respect to both spatial and temporal aspects and are activated only if the current air quality situation requires action. The reduction potentials of ETM strongly depend on the activation rate of the respective measure. For the total concentration, they range from a few percentage points at the low end up to 15% or up to 10 limit exceeding days (PM10) in specific designs. Thus, reduction potentials of ETM are in the same range as reduction potentials of LEZs.*

***Truck transit bans***
*The reduction potential of truck transit bans strongly depends on local conditions, notably on the share of trucks in overall road traffic and the expected compliance rate. As trucks have a higher reduction potential for non-exhaust emissions of particulate matter due to re-suspension and abrasion, reductions of the PM10 annual mean value by several percentage points can be expected even with lower truck shares. The theoretical potential to reduce total concentrations is always higher for NO2 than for PM10 and can reach more than 10% if truck share and compliance rate are suitably high (e. g. 6% truck share, 80% compliance rate in 2015).*

***Speed limits of 30 or 40 km/h on major roads***
*Reducing speed limits on major roads from 50 to 30 or 40 km/h is a measure that is especially difficult to quantify. The reduction potentials for pollutants caused by road traffic were assessed to 18 % for $NO_x$, 15 % for $NO_2$ und 30 % for $PM_{10}$.*

*More details on air quality planning, measures and the assessment of their effectiveness in Germany can be found in IVU Umwelt (2013): Inventory and effectiveness of measures to improve air quality. Published as UBA-Texte 05/2015 "Inventory and effectiveness of measures to improve air quality".*

*Contracting authority: German Federal Environment Agency (UBA). 2013.*
*Download: http://www.umweltbundesamt.de/publikationen/inventory-effectiveness-of-measures-to-improve-air*


***Download:*** ***http://www.umweltbundesamt.de/publikationen/inventory-effectiveness-of-measures-to-improve-air***

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***For more information please refer to:***
*https://www.emo-berlin.de/en/projects/urban-district-40/*

IVU Umwelt GmbH
Environmental planning · Information systems

# 04.

# *Technology and Innovation for Clean Air*

## MANY ROADS LEAD TO BETTER AIR QUALITY

*The following pages provide examples of technological solutions that reduce vehicle emissions as well as innovative technologies to replace car and lorry trips by more sustainable modes. This includes innovative logistics concepts as well as vehicle technologies used in public service vehicle fleets.*

## MAKING MOBILITY REAL - developing safer, greener and more connected solutions that move our world from what's now to what's next!

*Formerly known as Delphi Automotive, Aptiv emerges from the completion of Delphi's spin-off of its Powertrain segment, which today became Delphi Technologies PLC. Aptiv is built on a strong foundation of an industry leader, and has the knowledge, capability, and agility to offer greener, safer and more connected mobility solutions making sustainable mobility of the future real. The Customer Technology Center in Wuppertal, Germany, is one of Aptiv's major engineering centers in Europe with a long lasting successful tradition in breeding innovations.*
*As an innovative global technology company we still address some of mobility's toughest challenges, including the transition of active safety technologies into autonomous driving solutions. As vehicles have become increasingly defined by software, we have adapted our business, continuing to grow our software capability and our systems integration expertise. With our proven expertise in software and vehicle architecture we are making the world greener and more human than ever.*
*The information and safety systems of the future will exchange 100,000 pieces of data in a literal blink of an eye. Smart Vehicle Architecture (SVA) means to develop soft- and hardware even smaller, but more powerful for those enormously large data rates by optimizing the vehicle's architecture. We are unique in that our engineering teams can integrate whole systems through SVA, which enable all the electrification, active safety, automation, and connectivity features. We're delivering solutions for automated driving and automated mobility on demand that are not only effective but also cost-efficient, while significantly reducing vehicle related injuries and fatalities. Furthermore we are enabling the trend towards vehicle electrification with high-voltage electrification solutions that reduce CO2 emissions and increase fuel economy. Therefor we supply the "nervous system" of the vehicle with focus on lowering the cost of vehicle electrification reflecting the growing significance of next-generation architectures with high-speed data and electrical power distribution as the foundation for future mobility.*

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### *Text by APTIV*

***Contact**: Thomas Aurich, thomas.aurich@aptiv.com*

***For more information please refer to:***
*www.aptiv.com*


## EMISSION MEASUREMENT DEVICES AND TEST LANES FOR PERIODIC TECHNICAL INSPECTION (PTI)

*MAHA has the leading technology for Periodical Technical Inspection (PTI) on safety and emission relevant components for motor vehicles. MAHA develops and manufactures high-precision exhaust gas analysers and test lanes for all kinds of motor vehicles. With a worldwide expertise on PTI Projects, 20 own subsidiaries and 100 sales/service stations in over 150 countries around the world, we support municipalities, national governments and other stakeholders with our experience to set up, establish and reorganize PTI systems. These measuring devices help make sure that vehicles are in a technically perfect and environmentally friendly condition. As a member of many initiatives we support also NGOs in their activities to set up sustainable urban transport. In addition, MAHA's ISO 9001 and ISO 14001 certifications provide the highest environmental and energy efficiency standards over the entire lifecycle of its products.*

***Standard product or customised solution***
*MAHA's customers include vehicle workshops, inspection bodies, vehicle manufacturers and governmental organisations, with all of them relying on innovative MAHA technology in their development, maintenance and quality control. Alongside the extensive standard product ranges in the various segments, the Allgäu workshop fitting company provides expandable modular customised solutions for individual needs. The products are developed in Germany and produced at the company headquarters in Haldenwang near Kempten or in the nearby manufacturing plants in Allgäu, with a large portion of the components manufactured in-house. This allows high quality standards to be maintained in all product lines. The company's numerous certifications to international industrial standards are testimony to this.*

***Professional service***
*MAHA makes a point of providing optimum customer care throughout the entire life cycle of the product. Accordingly, the Allgäu workshop fitting company operates its own customer service department. The highly effective team provides installation, servicing, repair and calibration of workshop equipment.*

***Active environmental protection***
*MAHA is committed to protecting our environment and preventing waste of resources and is also involved in cross-sector climate-protection initiatives and is active in promoting sustainable business.*

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***Text by Maha (Maschinenbau Haldenwang GmbH).***

***Contact:*** *Antonio Multari, Antonio.Multari@maha.de*

***For more information please refer to:***
*www.maha.de/emission-tester.htm*

## THINK ABOUT TOMORROW

***Responsibility & sustainability***
*As early as in the 1980s, we identified which challenges would arise for mobility on environmental grounds. Therefore, our core business grew: technologies and products for the reduction of pollutant emissions from internal combustion engines. We owe our company success and market reputation to the consistent fulfilment of customer needs and market requirements. In case of the development, manufacture and waste disposal, we always use state-of-the-art technologies and processes, in order to take care of the environment and its resources.*
*Jointly with our customers, we structure a clean future for the company of tomorrow, thanks to HJS technologies, products and processes, as well as their sustainable further development.*

***We at HJS***
*As a family managed, middle-sized company with headquarters in Menden/Sauerland, we at HJS Emission Technology GmbH & Co. KG have long-standing experience and competence in the area of exhaust gas treatment. With approximately 450 employees, we develop, produce and market systems for the reduction of emissions of pollutants and corresponding components.*

*Our company HJS was founded in 1976 from an innovative idea and, even after more than 40 years, enthusiasm for technology is still a significant mainspring for our employees who are continuously developing new ideas, processes and products.*

*Caring for persons and the environment in this case arises from conviction in our own company. As well as the HJS products, the careful and responsible handling of human and natural resources also plays a central role in our everyday life. Our management system is correspondingly certified.*

*Integrity and sustainability are the main supports of our commercial action. Open and honest dealings with each other, as well as with business partners and customers, form the basis for our action within the company, right from the very first day. We therefore inform and train our employees regularly in the subject of business ethics, as well as in the areas of health provision, occupational safety and environmental protection.*
*The thought that we can make the world a little cleaner with our products motivates us. We ensure at all times that our products also do what our customers expect. As a result, we take over responsibility for product and society.*

***Competencies***
*Jointly with our customers and as a provider of exhaust gas treatment components and systems, we create solutions in the areas of original equipment and retrofit, spare parts and aftermarket, as well as in the area of tuning and motor sport. Our portfolio extends from the pipe up to complete*

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***Text by the HJS Emission Technology GmbH.***

***Contact:*** *Annette Ritz, annette.ritz@hjs.com*

***For more information please refer to:***
*www.hjs.com/aftermarket/products.html*

HJS Emission Technology



## INTRODUCING FUEL CELL-HYBRID BUSES IN COLOGNE REGION

*Sustainable mobility is one of the major challenges to a greener future. There are several possibilities to achieve this goal. One of them is using environmental friendly hydrogen and fuel cell technology. Already in 2011 Regionalverkehr Köln GmbH (RVK) started to deploy fuel cell-hybrid buses in the Cologne Region. The company aims to substitute all conventional diesel buses with zero emission vehicles in course of its project "Null Emission" (zero emission). Due to the requirements of RVK as a regional public transport operator, the fuel cell technology is a key technology in order to achieve this ambitious goal. Fuel cell buses offer almost the same range, flexibility, refueling time and availability as conventional diesel buses.*

*Due to the positive experience RVK made since 2011 with the deployment of two fuel cell busses the company ordered 30 additional fuel cell buses in 2018 to take a major step towards a sustainable, emission free public transport. In parallel, two additional hydrogen refueling stations will be constructed. The implementation of the innovative technology is financed by the European regional development fund, the federal state North Rhine-Westphalia, the Federal Ministry of Transport through the National Hydrogen and Fuel Cell Technology Innovation Programme II as well as the FCH JU (Fuel Cells and Hydrogen Joint Undertaking).*

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***Text by Regionalverkehr Köln GmbH.***

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***For more information please refer to:***
www.rvk.de

Regionalverkehr Köln GmbH

## CARGOTRAM IN DRESDEN - HOW TRAMCARS DO AVOID TRUCK TRANSFERS

*Since 2001 the city of Dresden is home of few tramway-based urban logistics system worldwide. Based on experiences with freight tramways in the middle of the 20th century the system was newly established to supply a Volkswagen production plant. An alternative logistics concept was the condition for the permission to build that "manufactory style" plant in the inner city area of Dresden. Two 60-meter CarGoTram trainsets connect the production plant with a peripheric logistics hub and replace three truck journeys on each ride.*

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***Text by VerkehrsConsult Dresden-Berlin GmbH.***

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***For more information please refer to:***
*http://www.eltis.org/discover/case-studies/cleaner-cargo-distribution-dresden-germany*

VCDB

## "KOMODO" - PILOT PROJECT FOR THE USE OF MICRO-DEPOTS AND CARGO BIKES IN DELIVERY TRAFFIC STARTED IN BERLIN

*Since June 2018, Germany's five largest parcel service providers have been using an inner-city transhipment centre for the first time, which is operated on a vendor-neutral basis. Each company has a micro-depot for individual use. From here, the parcels are delivered „on the last mile" of the supply chain with cargo bikes. The project will investigate the systematic adaptability of the model to other municipalities.*

*The Federal Ministry of the Environment, Nature Conservation and Nuclear Safety funds the project as part of the National Climate Protection Initiative.*

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### *Text by LNC LogisticNetwork Consultants GmbH*

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*Dag Rüdiger, dr@lnc-berlin.de*

# 05.

# *Taking Joint Action: Expertise and International Cooperation*

## 5.1 EXPERTISE ON CLEAN AIR

*This Federal Environment Agency web page offers regularly updated information about air and other topics related to this most important elixir of life. Find out here how air quality has developed and which pollutants are harmful to health. The webpage identifies sources of pollution and points out measures to combat it.*

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***Text by the Federal Environmental Agency (Umweltbundesamt).***

***Recommended further reading:***

https://www.umweltbundesamt.de/en/publikationen/air-quality-2017

Umwelt Bundesamt

## 5.2 CLEAN AIR FOR SMALLER CITIES IN THE ASEAN REGION (ASEAN-GERMAN TECHNICAL COOPERATION)

*Project duration: 2009 - 2016*
*Expanding industrial development and increasing motorisation have adverse impacts on the environment by deteriorating air quality, increasing greenhouse gas emissions and contributing to climate change. In the fight against these challenges, ASEAN cities face particular challenges. If air pollution and climate change mitigation is addressed, it is usually in large metropolitan areas. Despite their vital role in the country's development, smaller cities are rarely considered, and usually do not have access to reliable data on air quality.*

*The "Clean Air for Smaller Cities" project supported selected small and medium-sized cities in ASEAN member states in the development and implementation of clean air plans (CAPs). These plans aimed to improve air quality and support sustainable urban development. Participating countries included Cambodia, Indonesia, Lao PDR, Myanmar, Malaysia, the Philippines, Thailand, and Vietnam. The project was implemented by Deutsche Gesellschaft fur Internationale Zusammenarbeit (GIZ) GmbH on behalf of the German Federal Ministry for Economic Cooperation and Development (BMZ).*

*The project also established a training system on air quality ("Train-for-Clean-Air"). The training was customized for different stakeholder groups, such as decision makers, technical staff, non-governmental organisations and the media. Further, Environmental Ministries were supported in the refinement and/or development of national legislation on air quality. Political decision makers have shown remarkable interest in the project's activities. In Indonesia, self-financed emission inventories were developed in 12 more cities, following the project's approach. Also emission inventory guidelines were developed by the Ministry of Environment. With a focus on public participation and ownership, the project also helped to initiate cooperation between civil society, universities, city administrations and other institutions to work together towards better air quality.*

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***Text by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ).***

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## 5.3 ELECTRO-MOBILITY AND CLIMATE PROTECTION IN PR CHINA (SINO-GERMAN COOPERATION ON LOW CARBON TRANSPORT)


*On behalf of the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety of the Federal Republic of Germany (BMU), the Sino-German Cooperation on Low Carbon Transport is implemented by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH. The overall objective of the project is to support the development of low carbon transportation in China.*

*The project promotes and supports the Sino-German policy dialogue as well as the international expert exchange on climate change mitigation strategies in the transport sector with a focus on both urban and freight transportation. The dialogue further aims to foster the debate about the long-term climate and environmental impacts of new mobility technologies and services such as shared mobility or autonomous driving.*

*At the core of the project is the exploitation of energy savings and mitigation potentials in the transport sector. The project partners, the Ministry of Transport (MoT), national and local level transport research institutes as well as stakeholders on provincial and city level are advised on the development of a set of emission quantification tools to model low carbon transport development scenarios as well as emissions generated by urban and freight transport. Measurements are being performed that provide an impetus for strategy development in addition to quantifying the impact of implemented low carbon transport activities.*

*Piloting policies and measures related to transport efficiency, to standards for the use of technologies such as Big Data based traffic management or GPS based free-floating bike-sharing but also to Sustainable Urban Mobility Planning (SUMP) provides urban and private sector actors with information about mitigation options, and demonstrates their feasibility. These measures directly contribute to the development and implementation of robust sectoral climate change mitigation strategies on the city, provincial and national level and therefore to the decarbonisation of the Chinese transport sector as well as the implementation of Chinas Nationally Determined Contributions (NDCs).*

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## *Text by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ).*

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***For more information, please refer to:***
*www.sustainabletransport.org*

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## SUSTAINABLE MOBILITY – MADE IN GERMANY

*"Sustainable Mobility – Made in Germany" stands for sustainable, proven, resource efficient, innovative, trustworthy and flexible solutions for all domains of mobility and logistics services.*

***Germany has a long history of successful changes and transformations in the transport sector – including***

- *the establishment of comprehensive funding schemes*
- *the re-emergence of walking and cycling as safe and viable modes of transport*
- *the reorganization of the public transport sector*
- *the continuous development of progressive regulations*
- *the development of efficient propulsion systems*
- *the integration of different modes of transport, including multimodality in logistics and ecomobility*

*Academia, businesses, civil society and associations have gathered invaluable experience and skills in framing these transformations.*

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