



Bundesministerium
für Verkehr und
digitale Infrastruktur

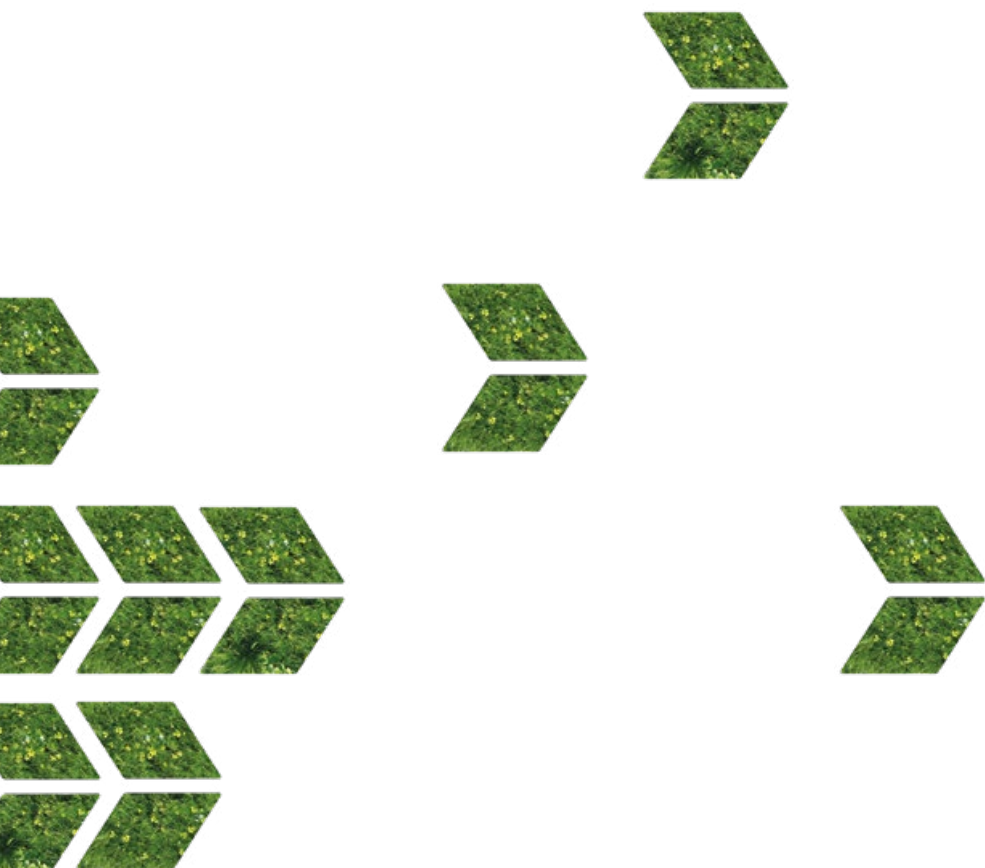
An Overall Approach to Climate-Friendly Commercial Vehicles

Towards zero emissions road logistics by means of alternative drivetrains



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The ten key messages of the Overall Approach to Climate-Friendly Commercial Vehicles











Objective of the 2030 Climate Action Programme	By 2030, vehicles powered by electricity or electricity-based fuels account for around one third of the mileage in heavy road haulage.		
General framework	A stringent pathway will reconcile the properties of alternative technologies with the requirements of users and providers.		
	Vehicle use	Technological properties	Vehicle manufacture and infrastructure provision
	<p>01 The use cases of the vehicles used in road haulage are many and varied. They result in different requirements to be met by the drivetrain technologies.</p> 	<p>03 The alternative drivetrain technologies have specific advantages and disadvantages. They should be deployed where they are most suited to the use cases.</p> 	<p>05 Alternative drivetrains will be an important component of the product portfolio. On the road towards economical production/provision, the existing significant market risks must be reduced and investment needs addressed.</p> 
	<p>02 The use of alternative drivetrain technologies must be competitive in terms of cost compared with conventionally powered vehicles.</p> 	<p>04 Decisions on scale-ups and pathways to be followed must be taken independently of the technological development steps, costs to the national economy and successful practical trials.</p> 	
	<p>➔ 06  The objective is achievable through a technology mix of drivetrains.</p>		
Measures	The Federal Ministry of Transport and Digital Infrastructure will guarantee the necessary planning and investment certainty through an integral package of measures .		
I Vehicle funding	<p>07  The Federal Ministry of Transport and Digital Infrastructure will fund the market ramp-up of commercial vehicles with climate-friendly alternative drivetrains without favouring any specific technology in order to meet the objective of making these vehicles economically competitive compared with conventional vehicles as quickly as possible.</p>		
II Infrastructure deployment	<p>08  The Federal Government will manage the deployment of refuelling and charging infrastructure geared to the vehicle ramp-up, thereby creating the necessary conditions for a market penetration of climate-friendly commercial vehicles.</p>		
III Regulatory framework	<p>09  The Federal Ministry of Transport and Digital Infrastructure will create a targeted regulatory environment ensuring that the products are competitive and that the players enjoy investment certainty. The regulatory core will be a differentiation of HGV tolls by CO₂ emissions from vehicles.</p>		
Implementation	Successful implementation of the Overall Approach will not be possible unless all stakeholders join forces and act in a targeted manner .		
	<p>➔ 10  The road haulage sector will not be able to leverage its potential for decarbonization unless all stakeholders make a joint commitment and take targeted action. The Federal Ministry of Transport and Digital Infrastructure is committed to dialogue and concerted action in the implementation of the Overall Approach.</p>		

Figure 1: The ten key messages of the Overall Approach to Climate-Friendly Commercial Vehicles

Introduction to the Overall Approach

The Overall Approach to Climate-Friendly Commercial Vehicles:

- addresses the key requirements of vehicle users and providers to be met by alternative drivetrains and the associated infrastructure for climate-friendly commercial vehicles;
- outlines the fleshing-out of the three core measures from the Federal Government's 2030 Climate Action Programme; and
- shows how the measures can be implemented in a targeted manner. To this end, the practical experience of all relevant stakeholders is to be incorporated. Because the only way to successfully progress along the road towards zero emission logistics is by taking concerted action.

A reduction of greenhouse gas emissions in Germany of 55 percent across all sectors and 42 percent in the transport sector against 1990 levels by 2030 is statutorily enshrined in the Federal Climate Change Act. As far as heavy road haulage is concerned, the Federal Government's 2030 Climate Action Programme states that **by 2030, vehicles powered by electricity or electricity-based fuels should account for around one third of the mileage.**

Road haulage is currently responsible for around one third of the CO₂ emissions from transport. Commercial vehicles with a conventional drivetrain based on diesel fuel account for almost the entire total mileage in this sector. The number of alternatively fuelled commercial vehicles (battery electric drivetrains, hydrogen fuel cell drivetrains and hybrid overhead line drivetrains) available on the market is still very low and is essentially limited to light commercial vehicles. Alternatively fuelled heavy-duty vehicles, on the other hand, are still predominantly at the development or pre-production stage. Moreover, the refuelling, charging and overhead line infrastructure required for alternatively fuelled commercial vehicles is currently not in place or there is not enough of it.

➤ **Commercial vehicles have to make a major contribution towards meeting the climate change targets. However, appropriate products have so far scarcely been available.**

In the heavy road haulage sector, in comparison with the passenger car segment, relatively few vehicles account for very high mileage. In addition, the operating cycles of these vehicles (three to five years) are comparatively short. Fleet replacement thus takes place significantly more frequently and after a shorter operating time. These distinctive features mean that **the heavy road haulage sector is predestined for an effective fleet replacement** in favour of alternative drivetrains. Given the high mileages, the use of low and zero emission vehicles can unlock a great potential for CO₂ reduction.

➤ **The Federal Ministry of Transport and Digital Infrastructure will create the appropriate regulatory framework for the use of low/zero emission heavy-duty vehicles in a timely manner in order to leverage the great potential for CO₂ reduction.**

Measures adopted and availability of funds

At European level, a powerful instrument has already been adopted that regulates fleet-wide CO₂ targets for new commercial vehicles¹.

¹ Regulation (EU) 2019/1242 of the European Parliament and of the Council of 20 June 2019 setting CO₂ emission performance standards for new heavy-duty vehicles and amending Regulations (EC) No 595/2009 and (EU) 2018/956 of the European Parliament and of the Council and Council Directive 96/53/EC.

This Regulation aims to reduce CO₂ emissions from the fleet of new vehicles sold throughout Europe by 30 percent (heavy-duty vehicles) and 31 percent (light commercial vehicles) by 2030. However, this Regulation will not by itself be sufficient to achieve the objective of one third of the mileage of heavy-duty vehicles (new or already in the fleet) being accounted for by electricity or on the basis of electricity-based fuels by 2030. Further measures are therefore needed for regulating the fleet. **These measures have been adopted in the 2030 Climate Action Programme.** For alternative drivetrains in commercial vehicles, they address first the additional costs of the vehicles, second the necessary deployment of the refuelling, charging and overhead line infrastructure and third the regulatory framework. The 2030 Climate Action Programme sets out the following essential measures with regard to heavy-duty vehicles:

- 1) make alternatively fuelled commercial vehicles more attractive by providing government funding and enhance planning certainty in the provision of funding;
- (2) develop strategies for charging facilities for battery-powered goods vehicles, overhead lines for good vehicles and hydrogen filling stations;
- (3) introduce CO₂ differentiation in the HGV tolling scheme and a CO₂ mark-up on HGV tolls effective as of 2023.

The decisions taken on climate change envisage additional funding over the period to 2023 in the economic plan of the Energy and Climate Fund. In 2020, these funds have been topped up by the Corona Economic Stimulus Programme. This means that, over the period to 2023, funds totalling around 1.16 billion euros will be available for funding alternatively fuelled commercial vehicles and funds totalling around 4.1 billion euros will be

available for deploying the refuelling, charging and overhead line infrastructure (passenger cars and commercial vehicles). The budget estimates are to be rolled forward beyond 2023.

An Overall Approach with a clear focus

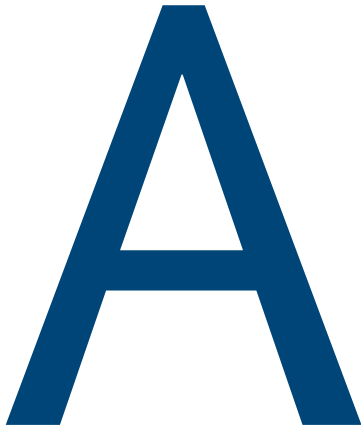
The Overall Approach to Climate-Friendly Commercial Vehicles sets out, on the basis of ten key messages (see Figure 1), the key requirements of users and providers to be met by alternatively fuelled commercial vehicles and the associated infrastructure, outlines how the three core measures from the 2030 Climate Action Programme are to be fleshed out and shows how the measures can be implemented in a targeted manner.

The present Overall Approach **focuses on the market ramp-up of alternative drivetrain technologies** for heavy road haulage² with high annual mileage, because the vehicles used in this sector require further innovative technological steps in terms of automotive engineering and infrastructure. It also addresses alternative drivetrains for light commercial vehicles.

In addition, numerous **further measures** are of significance for the decarbonization of road haulage. These include, but are not limited to, the use of advanced biofuels, electricity-based fuels (hydrogen in internal combustion engines, synthetic methane and power-to-liquid), measures based on digital technology (for instance in the field of automation and connectivity), improvements in vehicle aerodynamics and the adaptation of vehicle dimensions and weights. In addition, the conversion of bus and coach fleets to alternative drivetrain technologies will make a major contribution towards meeting our climate change targets. These issues will be assessed outside the present Overall Approach and supported by separate, specific Federal Government programmes and measures.

² "Heavy-duty vehicles" means vehicle categories N2 (maximum permissible weight exceeding 3.5 tonnes but not exceeding 12 tonnes) and N3 (maximum permissible weight exceeding 12 tonnes). The main focus of the Overall Approach is the heaviest weight category, i.e. articulated vehicles in particular.

A stringent pathway will reconcile the properties of alternative technologies with the requirements of users and providers.



A stringent pathway towards zero emission road logistics presupposes that the properties of the alternative technologies are reconciled with the requirements of users and providers.

The first priority for the freight transport, forwarding and logistics sectors is the usability of various drivetrain technologies for their specific transport movements in conjunction with the operational costs of the technologies. Since the various drivetrain technologies exhibit specific properties, inter alia in the dimensions of spatial usability and costs, it would appear appropriate to select the most suitable drivetrain technology for any given use case.

For reasons of efficiency and effectiveness, however, it is not likely that in the long term all alternative drivetrain technologies will be available in all weight categories in Germany and Europe. Accordingly, there is likely to be an appropriate mix of drivetrain technologies, which will emerge from the market requirements. Providers of vehicles and infrastructure are thus currently confronted by significant market risks and great investment needs.

It is up to government and industry to take complex technological pathway and scale-up decisions in the medium term. These decisions depend on future technological development steps, the costs to the national economy and the success achieved in practical trials.



01

The use cases of the vehicles used in road haulage are many and varied. They result in different requirements to be met by the drivetrain technologies.

The **services provided** by the freight transport, forwarding and logistics sectors are extremely many and varied. They differ, inter alia, in terms of the weight and type of the load and the haulage distance. This results in specific requirements to be met by the properties of the vehicles that are used to perform these movements.

A multiplicity of operating scenarios are made possible by **numerous different types of commercial vehicles** and their flexible usability. There are diverse axle configurations as well as a large number of superstructures and additional assemblies that are installed on the vehicles. In addition there is a wide range of weights from 1 to 3.5 tonnes maximum permissible weight in Category N1 to a regular maximum permissible weight of 40 tonnes in Category N3. In many cases, the corresponding product solutions are developed and supplied for specific customers or sectors.

- The Overall Approach to Climate-Friendly Commercial Vehicles covers all commercial vehicle categories (N1, N2 and N3) and takes into account the specific requirements of each category.

Of particular significance for entrepreneurial purposes are the operational requirements, i.e. essentially **the suitability of a vehicle product for everyday use**.

- A commercial vehicle must be able to meet all the requirements relevant to its specific use case.



02

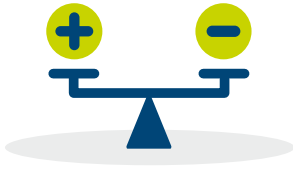
The use of alternative drivetrain technologies must be competitive in terms of cost compared with conventionally powered vehicles.

The road haulage sector is characterized by a **high level of competitive pressure**, which is reflected in very little scope for price setting. As a result of the simultaneous focus on costs by the shippers, forwarders and operators of commercial vehicles rely strongly on the costs of the provision of freight transport services being as low as possible. In this environment, even small individual cost increases can result in a market player being no longer competitive.

The competitiveness of a drivetrain technology thus depends crucially on the **total cost of ownership**. This means the costs incurred over the entire operating cycle from a business management perspective. It comprises the purchase costs minus the residual values plus the operating costs (especially energy and infrastructure costs including taxes and charges plus tolls).

At present, the purchase of alternatively fuelled commercial vehicles entails significantly higher costs than the purchase of conventionally fuelled vehicles. In many cases, it is not possible to offset these additional costs during the service life of the vehicles. There are currently a few isolated exceptions in the case of battery electric powered light commercial vehicles in urban operating scenarios.

- The purchase and operation of alternatively fuelled commercial vehicles must be competitive in terms of cost compared with conventionally powered commercial vehicles.



03

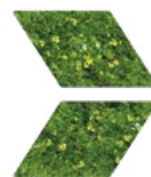
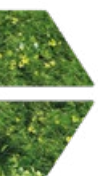
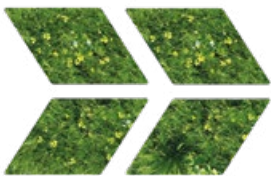
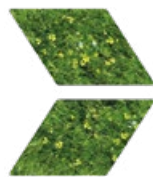
The alternative drivetrain technologies have specific advantages and disadvantages. They should be deployed where they are most suited to the use cases.

On the one hand, the various alternative drivetrain technologies exhibit specific properties due to their technology. These properties include the payload, range, purchase and running costs and the time needed to refuel or recharge.

On the other hand, certain requirements from the use cases are of significance for the suitability of alternative drivetrain technologies. The reason is the close interdependencies with the availability and use of the refuelling and charging infrastructure. These include the daily mileage, the frequency and length of breaks and standing times at the

depot, driver behaviour and the regularity of certain runs. The technology on the vehicle can also be subjected to specific requirements, for instance with regard to its performance on challenging topographies in the area of operation.

Taken together, the statements above mean that, because of technological constraints, **certain alternative drivetrain technologies are especially well suited or less well suited for certain use cases.** For light commercial vehicles in urban operating scenarios, battery electric drivetrains, for instance, are especially well suited. However, in the field of heavy-duty vehicles, in particular, there is currently not sufficient experience or findings with regard to the suitability of individual drivetrain technologies for specific use cases, which means that it is not possible to derive a clear trend.





04

Decisions on scale-ups and pathways to be followed must be taken as a function of the technological development steps, costs to the national economy and successful practical trials.

Decisions on the large-scale deployment of refuelling or charging infrastructure have **significant implications**. The deployment of infrastructure that will meet current and future needs is, after all, the basic prerequisite for the usability of an alternative drivetrain technology comparable to diesel. To achieve the desired knock-on effect on the range of vehicles available, the infrastructure is to be deployed such that it meets current and future needs and is to be synchronized with the ramp-up of the vehicles.

Policy decisions on infrastructure deployment must **be based on comprehensive assessments of the technology**. These assessments must comprise practical findings on the maturity and availability of the technology, the operational usability (including in other European countries) and on the costs from a business management perspective plus statements on the economic cost-benefit ratio. In addition, policy decisions that correspond to technology decisions in other European countries are to be taken. Moreover, the decisions should be supported by a broad-based consensus on the part of the users and providers.

- At an appropriate point in time during the technology trials, the Federal Ministry of Transport and Digital Infrastructure is to take decisions on the technological pathways to be followed, incorporating the perspective of the users and providers. This means the decision as to how and with what measures certain alternative drivetrain technologies are to be further scaled up for certain use cases.

At the present point in time, there are further important **technological development steps to be taken** in all three technology options. Moreover, there are differences regarding the readiness of the technologies for mass production. In concrete terms, this means that the current state of the art of some alternative drivetrain technologies makes them not yet ready for mass production or available in large numbers. Moreover, in the years ahead, significant developments in production technology will be required if a market ramp-up adequate for meeting the climate change targets is to be made possible.

The Overall Approach to Climate-Friendly Commercial Vehicles pursues the objective of identifying methods for the speedy market ramp-up of electric drivetrains for commercial vehicles with a supply of energy via battery, hydrogen fuel cells or overhead lines or combinations thereof. On this basis, **initial development is to be on a larger scale and involve comprehensive practical trials**. Decisions on scale-ups and pathways to be followed will then follow on from this.

The appropriate **time for such decisions on pathways to be followed** is when development and practical trial projects reveal resilient evidence regarding the potential inherent in a technology. The Federal Ministry of Transport and Digital Infrastructure will thus provide government support to such projects and corresponding test and pilot phases. The aim of the decisions on pathways to be followed is that by the end of the 2020s, **competitive products** that can be used without further government funding are available for each use case. The principle of the effective and efficient use of public funds mandates discontinuing government funding at a point in time when either the envisaged competitiveness of any given technology on a self-sustaining market has been achieved or the continuation of such funding is no longer justifiable in terms of the national economy and ecology.



05

Alternative drivetrains will be an important component of the product portfolio. On the road towards economical production /provision, the existing significant market risks must be reduced and investment needs addressed.

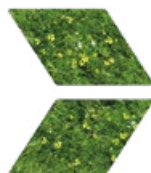
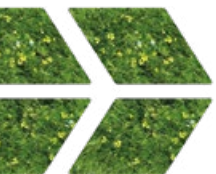
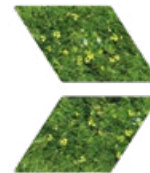
It is of key importance that vehicle manufacturers, component suppliers and infrastructure providers participate in the market ramp-up of alternative drivetrain technologies for commercial vehicles. As a result of the technological advances of recent years and the incentives provided by the European CO₂ fleet-wide targets for commercial vehicles, **it is already in the interests of manufacturers to see a reliable and speedy market ramp-up** of alternative drivetrains.

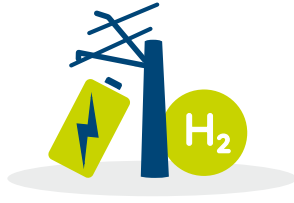
➤ **Alternatively fuelled vehicles and corresponding components will in the future be an indispensable element of the product portfolio of commercial vehicle manufacturers and component manufacturers.**

However, appropriate development and investment activities by the vehicle manufacturers are currently inhibited by a **high level of market uncertainty**. Every manufacturer relies on the technology it has developed catching on within the foreseeable future and the high development costs and investment in sufficient production capacity paying off in the long term.

The Overall Approach to Climate-Friendly Commercial Vehicles makes a key contribution towards reducing these uncertainties. To this end, there will be a scale-up phase in the years ahead in which, together with relevant market players, robust evidence on electric drivetrains for heavy-duty vehicles with a supply of energy via battery, fuel cell or overhead lines or a combination of these will be generated. On this basis, it will be necessary to take decisions on technological pathways to be followed with regard to a large-volume roll-out. These will result in infrastructure deployment that meets current and future needs and, together with the regulatory framework, will ensure that market uncertainty and investment needs are significantly reduced.

As early as the scale-up phase, the Overall Approach will, by providing support to vehicle procurement and local refuelling and charging infrastructure, create an **initial stable market demand** for alternatively fuelled commercial vehicles. This will create planning certainty for the manufacturers in this early phase.





06

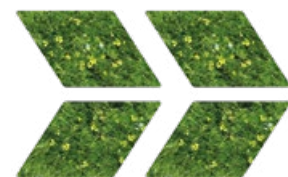
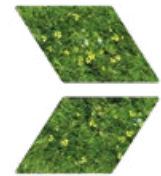
The objective is achievable through a technology mix of drivetrains.

The aforementioned requirements of users and providers to be met by the alternative drivetrain technologies illustrate that, on the basis of what is currently known, **a limitation to only one technology is not advisable** if one third of mileage is to be climate neutral by 2030. In the segment of battery electric powered light commercial vehicles, for instance, a growing number of vehicles ready for mass production can be observed, since these vehicles are especially well suited for use cases with low daily mileages. On the other hand, regarding the properties of the alternative drivetrain technologies for heavy-duty vehicles, verified findings on, inter alia, technologically feasible orders of magnitude are not yet available on a scale that would allow a clear trend to be derived.

To meet the climate change targets in the transport sector, the Federal Ministry of Transport and Digital Infrastructure is therefore committed to

a **technology mix** in the alternative drivetrains for commercial vehicles. However, this approach does not mean that suitable technologies will be selected at random. During the scale-up phase, the zero emission potential will be scrutinized. In addition, criteria such as efficiency, availability in terms of time, scalability, energy provision, costs of the infrastructure to be deployed, user acceptance and other suitable criteria will be scrutinized.

Going forward, decisions on technology pathways to be pursued further are to be taken as a function of these criteria and incorporating the perspective of the relevant stakeholders. It is not yet possible to state conclusively which technology mix will prevail on this basis, including in the roll-out phase.



The Federal Ministry of Transport and Digital Infrastructure will ensure the necessary planning and investment certainty through an integral package of measures.

B

With the Overall Approach to Climate-Friendly Commercial Vehicles, the Federal Ministry of Transport and Digital Infrastructure is presenting an integrated package of measures with three elements: vehicle funding, infrastructure deployment and a regulatory framework. Timewise, the package is based on the forecast availability of the various alternative drivetrain technologies for commercial vehicles. In terms of substance, the package is based on the technological constraints that have to be taken into account for the various alternative drivetrain technologies and their deployment. These technological constraints are set out in key messages 1 to 6. A concise summary of the most important technological steps can be found in the **Drivetrain Technologies Roadmap**. Figure 2 shows a scaled-down version of the Alternative Technologies Road Map, which was developed by Working Group 1 of the National Platform on the Future of Mobility.

The **Federal Ministry of Transport and Digital Infrastructure's Road Map of Measures** is also based on this time structure (cf. also Figure 2). The individual measures have their focus in different phases (core impact period) and are described below in key messages 7, 8 and 9. This package of measures forms the basic framework for the direction to be taken by climate change policy in the field of alternative drivetrains in road haulage in Germany over the period to 2030. It is not to be seen as final, but is to be updated regularly by the Federal Ministry of Transport and Digital Infrastructure on the basis of trends. Actual implementation will require the active involvement of and coordination between all stakeholders.

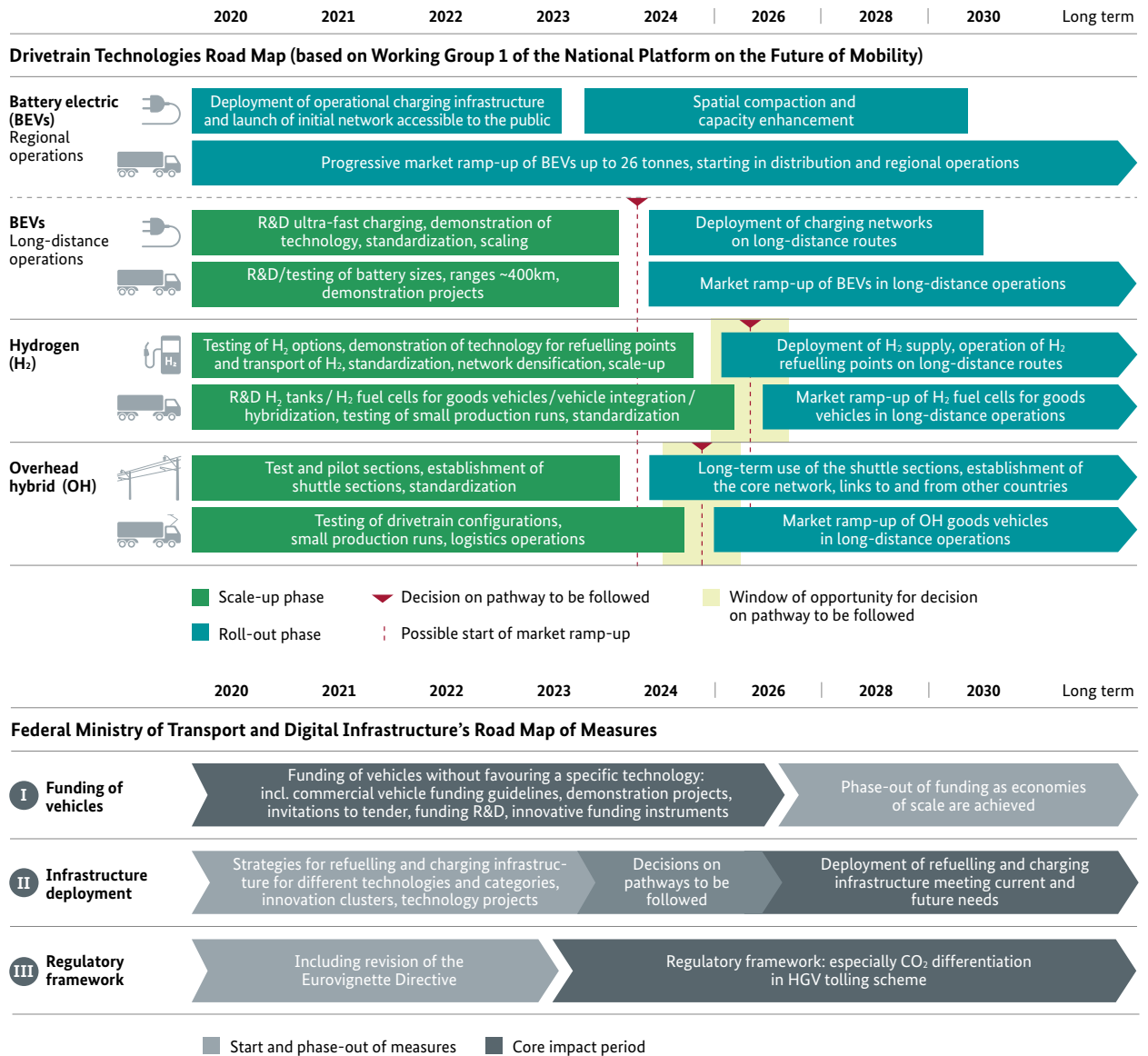


Figure 2: Interaction between the Road Maps of Drivetrain Technologies and Measures



07

The Federal Ministry of Transport and Digital Infrastructure will fund the market ramp-up of commercial vehicles with climate-friendly alternative drivetrains without favouring any specific technology in order to meet the objective of making these vehicles economically competitive compared with conventional vehicles as quickly as possible.

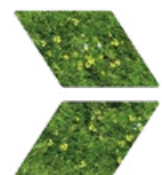
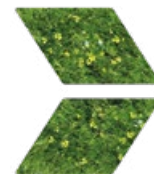
In the years ahead, the Federal Ministry of Transport and Digital Infrastructure will continue to fund the establishment of commercial vehicles with climate-friendly drivetrains without favouring a specific technology. This is designed to make a contribution towards achieving economic competitiveness with conventional vehicles as quickly as possible.

The Funding Guidelines for Energy-Efficient and/or Low-Carbon Heavy-Duty Vehicles have been in place since July 2018. With these guidelines, the Federal Ministry of Transport and Digital Infrastructure has been supporting the purchase of goods vehicles and semi-trailer towing vehicles having a maximum permissible weight exceeding 7.5 tonnes and being subject to tolls and that are powered by compressed natural gas (CNG), liquefied natural gas (LNG), battery or hydrogen. The future funding of alternatively fuelled vehicles

is to be significantly expanded. For **funding the purchase** of commercial vehicles with alternative climate-friendly drivetrains, the Federal Ministry of Transport and Digital Infrastructure has 1.16 billion euros at its disposal over the period from 2021 to 2023. In the future, the funding will cover vehicles in EC vehicle categories N1, N2 and N3 and, if necessary, additionally the refuelling and charging infrastructure required for their use, for instance for charging at the depot. The planned financial assistance programme for electrically operated commercial vehicles (battery electric vehicles, hydrogen fuel cell vehicles and externally rechargeable hybrid electric vehicles) envisages a significantly enhanced aid intensity.

If there is a need in the future for further research in individual cases, the **funding of research and development projects** will continue to be possible within the scope of the existing programmes, such as the National Hydrogen and Fuel Cell Technology Innovation Programme or the Electric Mobility Funding Guidelines.

In addition, the Federal Ministry of Transport and Digital Infrastructure will also explore the use of **new and innovative funding instruments** (for instance tendering models) covering both vehicles and infrastructure.





08

The Federal Ministry of Transport and Digital Infrastructure will manage the deployment of refuelling and charging infrastructure geared to the vehicle ramp-up, thereby creating the necessary conditions for a market penetration of climate-friendly commercial vehicles.

The market ramp-up of alternatively fuelled commercial vehicles requires adequate and reliable energy supply infrastructure. This is a basic prerequisite for the successful operational integration and spread of climate-friendly commercial vehicles in Germany.

The crucial factor here is that the deliberations on how to design the refuelling and charging infrastructure must focus on the requirements of the users. Because it is the users who will decide whether the existing infrastructure is sufficient and satisfies their requirements and needs in terms of quality and costs.

The Federal Ministry of Transport and Digital Infrastructure will manage the deployment of a heavy commercial vehicle infrastructure coordinated with the vehicle ramp-up by means of a **two-phase strategy**. Funds totalling around 4.1 billion euros over the period to 2023 are available for the deployment of the refuelling and charging infrastructure (passenger cars and commercial vehicles).

Infrastructure for Category N2 and N3 heavy-duty vehicles: scale-up phase (3 to 4 years starting in 2020)

As a basis for the deployment of the infrastructure, the **first phase** (“**scale-up phase**”), starting at the end of 2020, will involve joining forces with all the stakeholders and taking the following action for the three alternative drivetrain technologies envisaged in the 2030 Climate Action Programme (battery electric drivetrains, hydrogen fuel cell drivetrains and hybrid overhead line drivetrains):

- (1) trialling the practical usability in real-world logistics processes;
- (2) taking outstanding development steps;
- (3) setting standards; and
- (4) developing specific plans for an area-wide deployment of the necessary infrastructure.

In this way, robust evidence will be generated on the three technologies with regard to technological maturity, operating costs and costs to the national economy, and practical usability. On this basis, the Federal Ministry of Transport and Digital Infrastructure will be able, starting in around 2023 and incorporating users and providers, to progressively take decisions on policy pathways to be followed regarding the nature and scope and thus the subsequent area-wide deployment of the various technologies.

Re (1): in concrete terms, the technologies will be trialled by projects involving interaction between vehicles and infrastructure in *innovation clusters* (longer corridors, larger sub-networks). For battery technology, the focus will be on the operational demonstration of the technology and, in particular, its interaction with the charging infrastructure. Here, account will be taken of the interdependencies with the deployment of the charging infrastructure for passenger cars. In the case of hydrogen fuel cell technology, the emphasis will be on the demonstration of vehicle technology and refuelling, the harmonization of refuelling standards and the transport of hydrogen. In the case of overhead line technology, the focus will be on the establishment of suitable test and pilot routes, especially on shuttle routes that have a high volume of traffic regionally, and on trialling in combination with various vehicle configurations (e.g. diesel hybrid, hydrogen fuel cell hybrid, battery hybrid, battery sizes, etc.).

Re (2): individual components of great technological significance will be developed and demonstrated alongside this in focused *technology projects*.

Here, the focus may be on, for instance, ultra-fast charging in the case of battery technology and the testing of various hydrogen options (including refuelling, storage and supply plus liquefied versus gaseous hydrogen) in the case of hydrogen fuel cell technology.

Re (3): within this phase, *standardization* will be expedited for all three technologies. To this end, the expertise of appropriate players and bodies will be closely incorporated.

To reach a common denominator for the infrastructure ramp-up in the following second phase, all relevant stakeholders will be involved in the innovation clusters and technology projects and in the standardization.

Re (4): by way of preparation for a later deployment of the individual infrastructures – about whose scope no decision had been taken at the time of the scale-up phase – concrete plans for an area-wide deployment of infrastructure (incl. business location strategies for all technologies) and organization models for the provision and funding of the infrastructure will already be developed in this phase. By having the appropriate deployment plans ready at the time at which the pathway decisions are taken, it will be possible to avoid delays.

As a basis for the infrastructure deployment, the Federal Ministry of Transport and Digital Infrastructure, with the involvement of the monitoring consortium of the Federal Government's Mobility and Fuel Strategy and the expertise of further appropriate stakeholders and bodies, will, by the summer of 2021, identify various use cases for heavy road haulage and also evaluate tolling data for this purpose.

Given that the flows of goods are intertwined throughout Europe, it should be borne in mind that if the alternative drivetrain technologies can be used only on a national basis, their prospects of success may be reduced. In the scale-up phase, therefore, discussions with the EU Member States and, in particular, with our neighbours on their technology and infrastructure planning activities

will be stepped up. The aim is to share the findings from Germany and stimulate a coordinated deployment of infrastructure throughout Europe. This requires an impetus to be provided by the European Commission. The deployment of cross-border infrastructure on the TEN-T corridors can be supported by funding from the Connecting Europe Facility. An important regulatory impetus given by the European Commission is provided by the revised Directive 2014/94/EC on the deployment of alternative fuels infrastructure, which has been announced for 2021. This will establish the framework for an interoperable and future-proof infrastructure. Major requirements from a German perspective are the deployment of a high power recharging network on the corridors, the establishment of European standards for heavy goods vehicle traffic and the commitment to deploy fuel infrastructure for hydrogen refuelling. The Federal Ministry of Transport and Digital Infrastructure will contribute the latest findings from the scale-up phase to the revision of the Directive.

Infrastructure for Category N2 and N3 heavy-duty vehicles: roll-out phase (end of the scale-up phase to 2030)

In the **second phase (“roll-out phase”, starting around the end of 2023)**, the necessary energy supply infrastructures will be deployed in a coordinated manner, focusing on those for alternatively fuelled heavy-duty vehicles. This will take place on the basis of the decisions on pathways to be followed taken by the Federal Ministry of Transport and Digital Infrastructure and incorporating the perspective of the users and suppliers.

Having in place sufficient refuelling and charging infrastructure accessible to the public will be crucial to the decisions by users to purchase such vehicles and thus to the market ramp-up of climate-friendly commercial vehicles. It will thus be necessary for the Federal Ministry of Transport and Digital Infrastructure to plan proactively in order to make possible a deployment of publicly acces-

sible energy supply infrastructures that is initially disproportionately high and prepares the market in an anticipatory manner. Accordingly, the roll-out phase must start with an intensive infrastructure deployment and subsequently transition on this basis into an increasing vehicle ramp-up over the period to 2030.

For the operation of the hydrogen refuelling points, the transport and distribution infrastructure for hydrogen also has to be evolved. This measure is already included in the National Hydrogen Strategy. To cover the demand for green hydrogen for use in transport, international fuel partnerships are to be developed alongside the existing energy partnerships, thereby ensuring that the requirements of the transport sector are taken into account.

In addition, strategies for the support and organization of private sector (company) energy supply infrastructure will be developed. This concerns in particular charging facilities for battery-electric goods vehicles on company premises that are used by goods vehicles both belonging and not belonging to the company.³

To ensure the coordinated ramp-up of the charging infrastructure for battery electric passenger cars, the National Coordination Centre for Charging Infrastructure was established at the end of 2019. The lessons learned by the Centre are to be used and synergies for the ramp-up of the energy supply infrastructures for climate-friendly commercial vehicles created. For this purpose, the National Coordination Centre for Charging Infrastructure will be closely integrated into the deployment of charging infrastructure for commercial vehicles.

The basic prerequisite for the ramp-up of any given technology and for the fast, continuous and well-targeted deployment of the energy supply infrastructures is the availability of attractive and competitive vehicles for the mass market. As a basis for proactive planning of the energy supply infra-

structures, it must therefore be known at an early stage how many and what types of vehicles will enter the market and what technical specifications they will have. The Federal Ministry of Transport and Digital Infrastructure will create a format compliant with antitrust law to gather this information for the first time and update it reactively.

The market ramp-up of climate-friendly commercial vehicles over the period to 2030 will not be successful unless the projects contained in Phase 1 are commenced immediately.

Category N1 light commercial vehicles

Light commercial vehicles can be powered by battery electric drivetrains and hydrogen fuel cell drivetrains.

For light commercial vehicles in use cases with low daily mileages, the technological focus is on battery technology because – as in the passenger car sector – concrete battery electric schemes suitable for the mass market are already foreseeable. The Federal Ministry of Transport and Digital Infrastructure has for years been supporting the deployment of company charging infrastructure with the Electric Mobility Funding Guidelines in connection with the ordering of vehicles. A financial assistance programme for the deployment of non-public charging infrastructure for traders is planned for the period starting in 2021. In addition, the Ministry is managing the deployment of the first publicly accessible high power charging network for light commercial vehicles, among others. In the years that follow, the network for light commercial vehicles will be made denser and capacity at existing sites will be enhanced.

In the light commercial vehicle sector, hydrogen fuel cell drivetrains are especially suitable for use cases with greater range requirements. The first prototypes have already been announced.

³ These strategies will draw on Federal Ministry of Transport and Digital Infrastructure financial assistance programmes already existing in the first phase (Electric Mobility Funding Guidelines and Financial Assistance Programme for Private Sector and Commercial Charging Infrastructure (500 million euros, starting in 2021) and Financial Assistance for the Purchase of Vehicles with Alternative Climate-Friendly Drivetrains (around 1.16 billion euros, starting in 2021)) and are to ensure a broad-scale impact.



09

The Federal Ministry of Transport and Digital Infrastructure will create a targeted regulatory environment ensuring that the products are competitive and that the players enjoy investment certainty. The regulatory core will be a differentiation of HGV tolls by CO₂ emissions from vehicles.

In addition to funding vehicles and managing the deployment of the infrastructure, the Federal Ministry of Transport and Digital Infrastructure will create – as the third element of the package of measures – an appropriate and reliable regulatory framework for the use of alternatively fuelled commercial vehicles.

The framework will address the high cost pressure and the international competitiveness that characterize the road haulage sector. The Ministry would like to ensure that this framework does not favour a specific technology. In accordance with the Overall Approach, the composition of the technology mix will be largely based on the lessons learned during the scale-up phase.

The regulatory core will be a **differentiation of HGV tolls by CO₂ emissions** from a goods vehicle. For the first time, a mark-up depending on CO₂ emissions will be levied on the toll. On the other hand, goods vehicles that emit only little or no CO₂ are to be granted a reduction of the infrastructure charge of up to 75 percent compared with the infrastructure charge for the vehicles with the highest emission levels. This option is also to apply to hybrid vehicles, which are to be treated as zero emission vehicles on sections of road on which it can be proved that they did not produce any emissions. This will create reliable price signals for the operation of climate-friendly commercial vehicles subject to tolls. These signals

will provide a key incentive for a shift from high-emission to climate-friendly technologies. The CO₂ component will additionally incentivize the development of climate change innovations for commercial vehicles and investment in climate-friendly technologies. The instrument will not favour a specific technology, because it will focus on reducing emissions and not on the drivetrain technology used to achieve these reductions.

The Federal Ministry of Transport and Digital Infrastructure will lobby for this mechanism at European level within the context of the recast of the Eurovignette Directive. The aim is to introduce CO₂ differentiated tolls starting in 2023.

As the HGV tolling scheme is recast, instruments will be developed with which it will be possible to avoid imposing a double burden on the road haulage industry through the increased expenditure on fuels under the Fuel Emissions Trading Act. This will also help to avoid distortions of competition vis-à-vis foreign road haulage operators.

The running costs of the various alternative drivetrain options are strongly influenced by the energy prices, on which various state-imposed **taxes and charges** are levied.⁴ The Federal Ministry of Transport and Digital Infrastructure would therefore like to examine, in consultation with the government departments having lead responsibility, whether, and if so how, it would be appropriate to modify these governance tools in order to facilitate the market ramp-up of climate-friendly commercial vehicles. This will widen the examination already included in the Federal Government's National Hydrogen Strategy (June 2020) specifically for the production of green hydrogen. It will also take into account effects in other sectors and on the funding function.

⁴ Taxes and charges also impact on the prices of electricity-based fuels. Since the aim of the Overall Approach to Climate-Friendly Commercial Vehicles is the market ramp-up of alternative drivetrains, the ramp-up of alternative fuels – in which transposition of the recast Renewable Energy Directive (RED II), in particular, is also of the greatest importance – is not addressed here.

Successful implementation of the Overall Approach will not be possible unless all stakeholders join forces and act in a targeted manner.

C



10

The road haulage sector will not be able to leverage its potential for decarbonization unless all stakeholders make a joint commitment and take targeted action. The Federal Ministry of Transport and Digital Infrastructure is committed to dialogue and concerted action in the implementation of the Overall Approach.

If Germany is to meet its climate change targets in the transport sector while remaining a leading manufacturing and logistics nation, government and industry have to work hand in hand on the rapid spread of climate-friendly commercial vehicles. The Overall Approach to Climate-Friendly Commercial Vehicles will thus be implemented through concerted action by all stakeholders.

Three focal points of the concerted action

The focus of the concerted action will be on the activities in the scale-up phase – which will start by the end of 2020 – in the field of refuelling, charging and overhead line infrastructure.

First, **the launch of specific trialling projects** in “innovation clusters” is of the utmost importance for this purpose. In these projects, infrastructure is to be deployed on a large scale and used by vehicles in real-world settings in order to demonstrate the practical usability of the technologies in existing logistical processes and generate lessons learned for decisions on pathways to be followed and a possible further network deployment. The projects are to cover longer corridors or larger sub-networks (“innovation clusters”). It is also to be possible to trial several technologies in parallel in the same innovation cluster so as to be able to subject the technologies to a direct comparison and identify synergies. The projects are to be delivered jointly by vehicle manufacturers, users, infrastructure providers and the energy supply industry and are to be academically monitored.

Second, there are to be specific technology projects to develop individual components of particular significance and demonstrate their usability. Here, the focus will be on, for instance, ultra-fast charging in the case of battery technology and the testing of various hydrogen options in the case of hydrogen fuel cell technology.

Third, procedures for jointly answering unresolved issues of standardization (infrastructure and interfaces with the vehicle) will be supported. Measures for expediting standardization processes are to be identified.

Organization of the concerted action

The Federal Ministry of Transport and Digital Infrastructure will use two methods to involve vehicle manufacturers, users, infrastructure providers, the energy supply industry and other important stakeholders in the implementation (cf. Figure 3). The Ministry will establish a **higher level council**

cil comprising high-level decision-makers from the field of alternatively fuelled climate-friendly commercial vehicles. The aim is to include the perspective of the parties involved as a basis for, in particular, the forthcoming decisions on technological pathways to be followed. The Council will meet as necessary.

The concerted implementation will also be prepared and launched by **temporary ad hoc task forces** at working level. The aim is that the task forces address open action areas in the three aforementioned priority areas (trailing projects, technology projects and standardization) within the individual technologies (battery electric drivetrains, hydrogen fuel cell drivetrains and hybrid overhead line drivetrains) and engage in close exchange with the Federal Ministry of Transport and Digital Infrastructure to develop assessments and recommendations. The groups will be put together ad hoc for each topic. The National Coordination Centre for Charging Infrastructure will

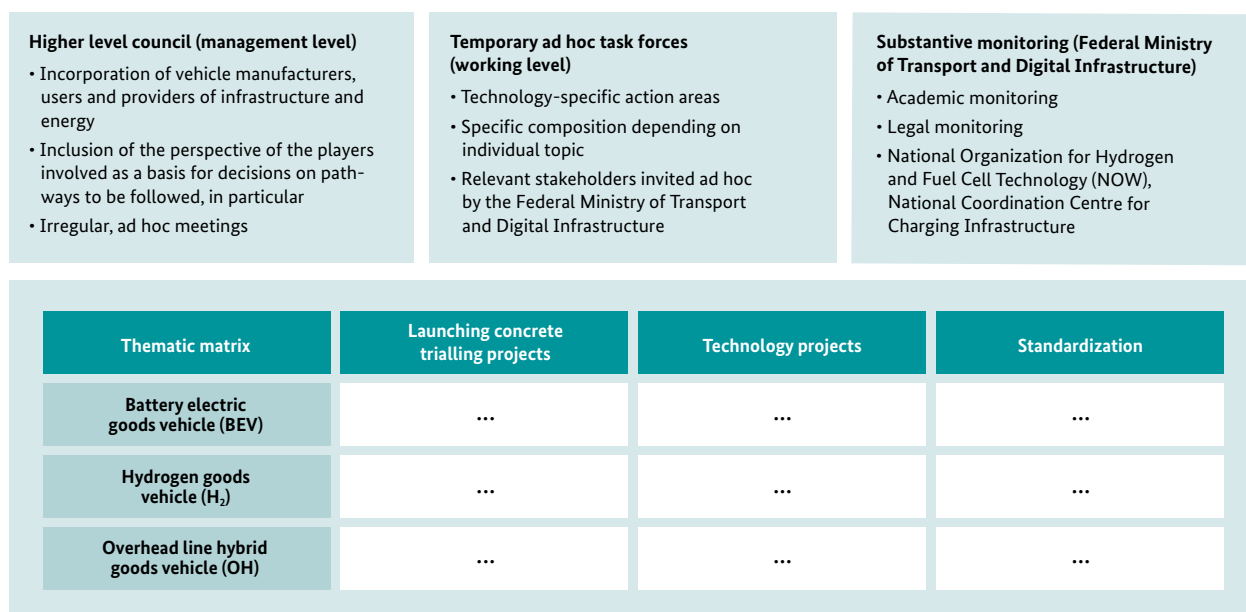


Figure 3: The organizational structure of the concerted implementation

also be closely involved specifically in the topic of battery charging infrastructure.

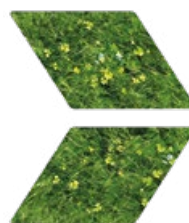
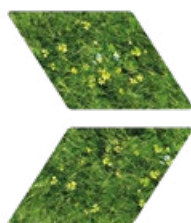
Issues to be addressed directly in task forces in the field of battery technology include, for instance, calculations of requirements (number of sites), charging capacity and grid connections, site selection (rest areas, truckstops, depots), the design of charging parks and posts (layout), interface standards (including charging plugs) and, on this basis, the identification and launching of suitable trialling projects and technology development projects. One of the issues to be addressed directly in the field of hydrogen fuel cell technology is the commitment to a storage technology for vehicle refuelling. For the hybrid overhead lines technology, there must be a calculation and reviews of requirements, for instance.

In parallel with the activities of the higher level council and the temporary ad hoc task forces, there will also be **close monitoring** of the activities by the Federal Ministry of Transport and

Digital Infrastructure **across all the technologies**. The aim is to generate an up-to-date overview of the state of knowledge on the three technologies, to identify cross-references (for instance possible synergies in the deployment) and expedite cross-technology topics. This will draw on the expertise from the monitoring consortium of the Federal Government's Mobility and Fuel Strategy.

Updating the Overall Strategy

The Federal Ministry of Transport and Digital Infrastructure will submit the implementation of the Overall Approach to Climate-Friendly Commercial Vehicles to a monitoring process, evaluate successful cases of implementation and, if necessary, update the Overall Approach.



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