



ELISA eHighway

**A pilot project for sustainable
heavy goods traffic**



**Climate protection
is a widely debated,
important issue.**

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A clever solution

For a small but essential part of a big challenge

Meeting climate protection goals requires major efforts. The transport sector has to make a significant contribution: changing to alternative drives.

Electromobility is the key element of an energy turnaround in transport

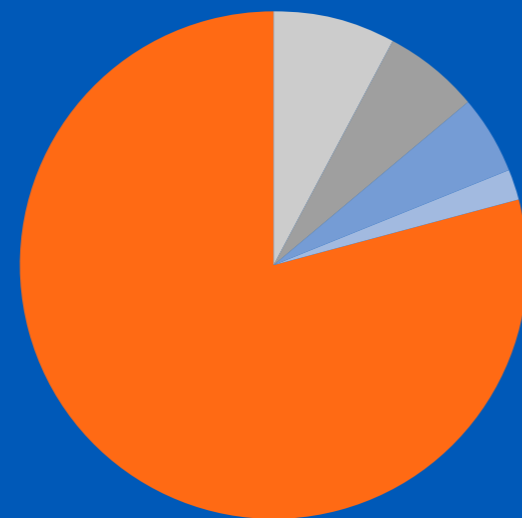
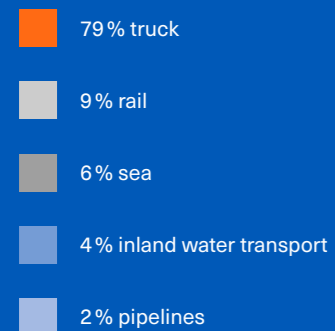
Electricity is most efficient. Avoiding transport, a modal shift in transport and improving efficiency save up to 60 per cent CO₂. An almost complete reduction of CO₂ emissions in freight transport can only be achieved by using alternative fuels and drives.

Energy is valuable, so it should be used wisely.

Alternative drives are

- electromobility (incl. plug-in hybrids, range extender vehicles and catenary vehicles)
- fuel-cell vehicles with hydrogen from regeneratively produced electricity
- combustion engines with liquid and gaseous fuels generated from electricity

What mode of transport is currently being used to take goods from A to B within Germany?

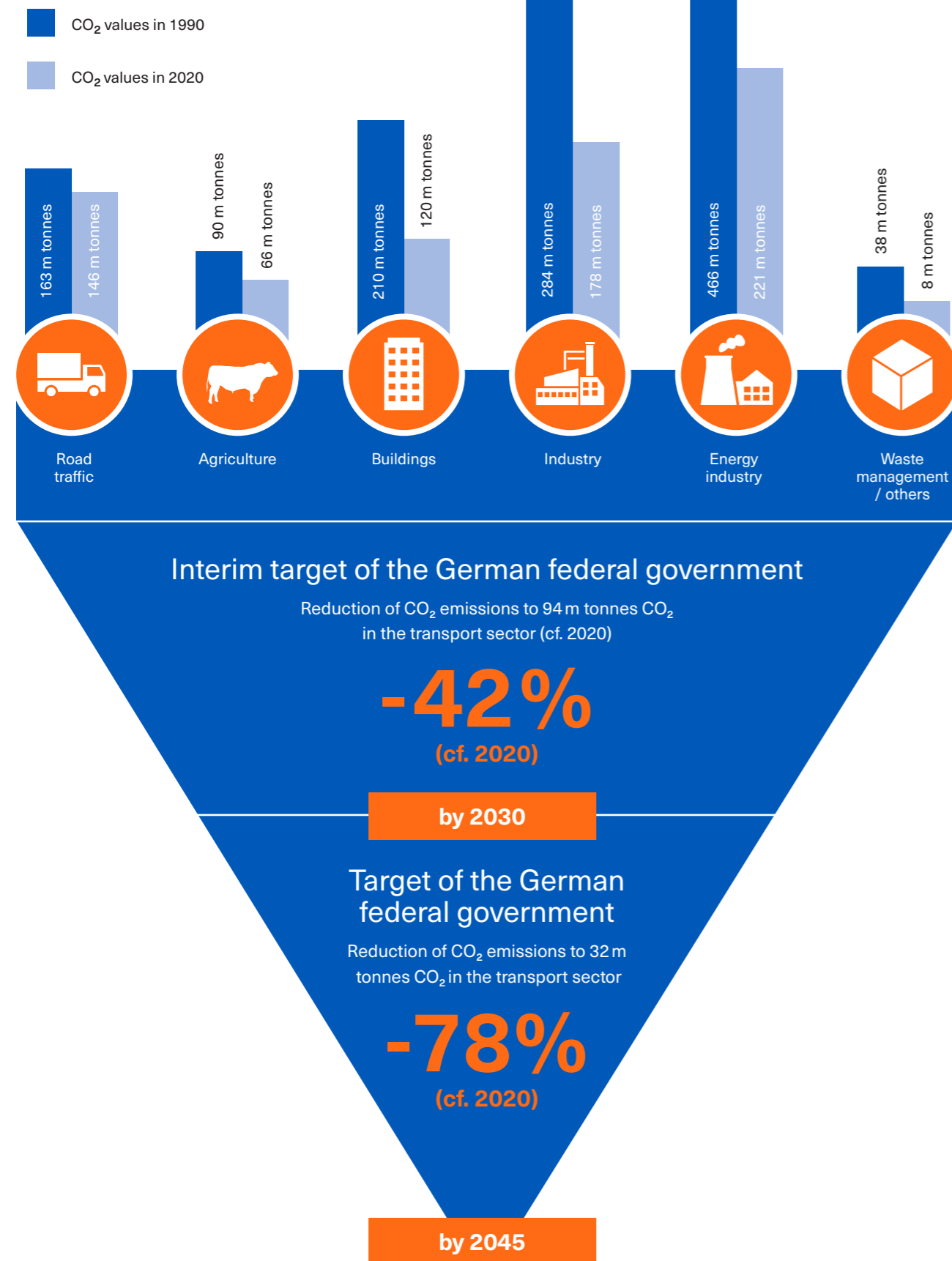


Traffic forecast 2030*:
Compared to 2010,
road transport volume
will grow by

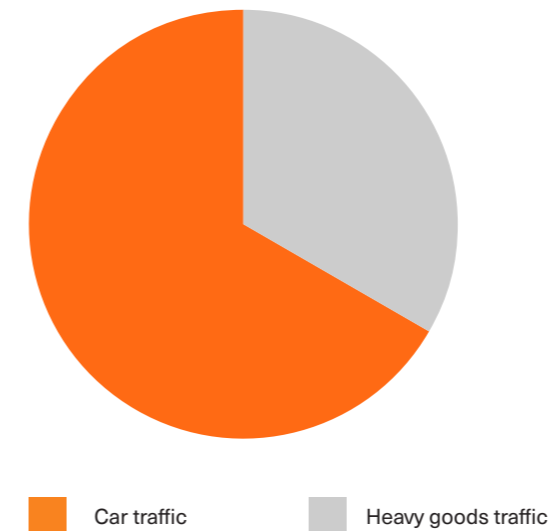
39%

*Source: Federal Ministry of Transport
and Digital Infrastructure

Targets for the reduction of CO₂ emissions in Germany



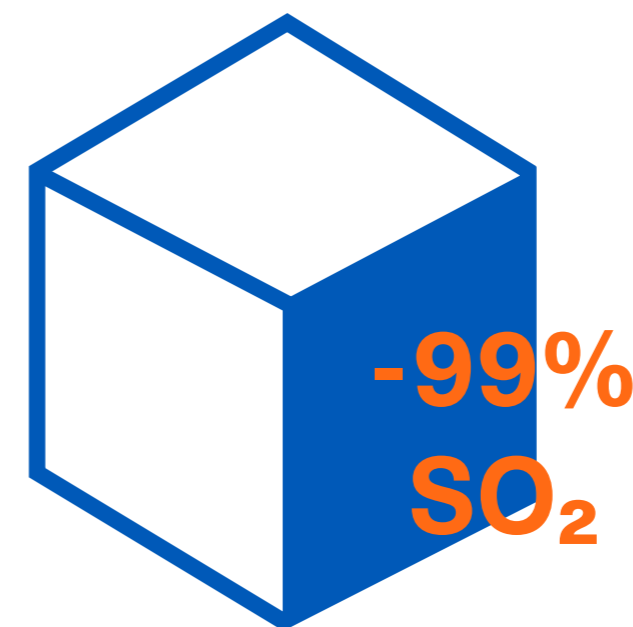
CO₂ emissions in road traffic



Electricity requirement for a distance of 100 kilometres

The power required per 100 kilometres for electrically powered vehicles is up to 90 per cent lower than for combustion engines and 50 per cent lower than for fuel cells.

In the end the question remains: How does the electricity get into the truck?



One goal already achieved

1995–2017

Sulphur dioxide emissions in truck traffic have fallen by more than 99 per cent per tonne-kilometre since 1995 due to better engines, exhaust technology and better fuel quality.

eHighway Hesse: on track to the most environmentally friendly motorway in Europe



The test track in the Rhine-Main area



The ELISA project represents Germany's first eHighway and thus a new dimension of electromobility: Truck transport along state-of-the-art infrastructure as an important component in the electrification of heavy goods transport. ELISA shows the way how the transport sector can make a significant

contribution to achieving national climate protection goals. This is to be scientifically proven by a comprehensive field trial.

As a first part of the ELISA project, the eHighway Hesse was built on ten kilometres of the A5 motorway between the Langen/Mörfelden and Weiterstadt junctions. Within two years a catenary system was built, that can supply power to catenary hybrid trucks. This created the technical prerequisites for the field test.

Test track A5

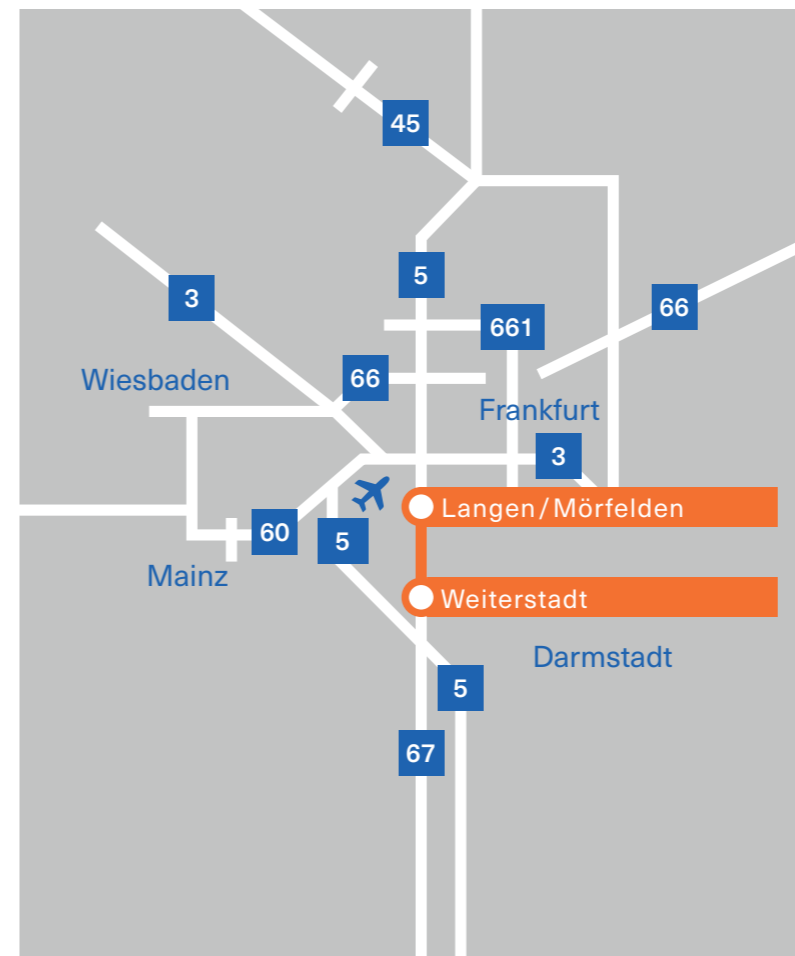
The densely populated **Rhine-Main area** close to **Frankfurt Airport** and the "Frankfurter Kreuz" motorway junction provides optimal test conditions.

8-lane motorway: 134,000 vehicles / day
Share of heavy goods traffic: approx. 10%
Overall length eHighway: electrification of the right-hand lane for 5 kilometres in each direction

The key criteria for the selection of the test track were:

- the representation of the track with regard to the transferability of the research results to further sections of the motorway,
- a challenging operational environment with high public visibility,
- the location of the test track with regard to its potential to handle as many journeys as possible within existing transport networks.

The test track in Hesse was established in 2018.



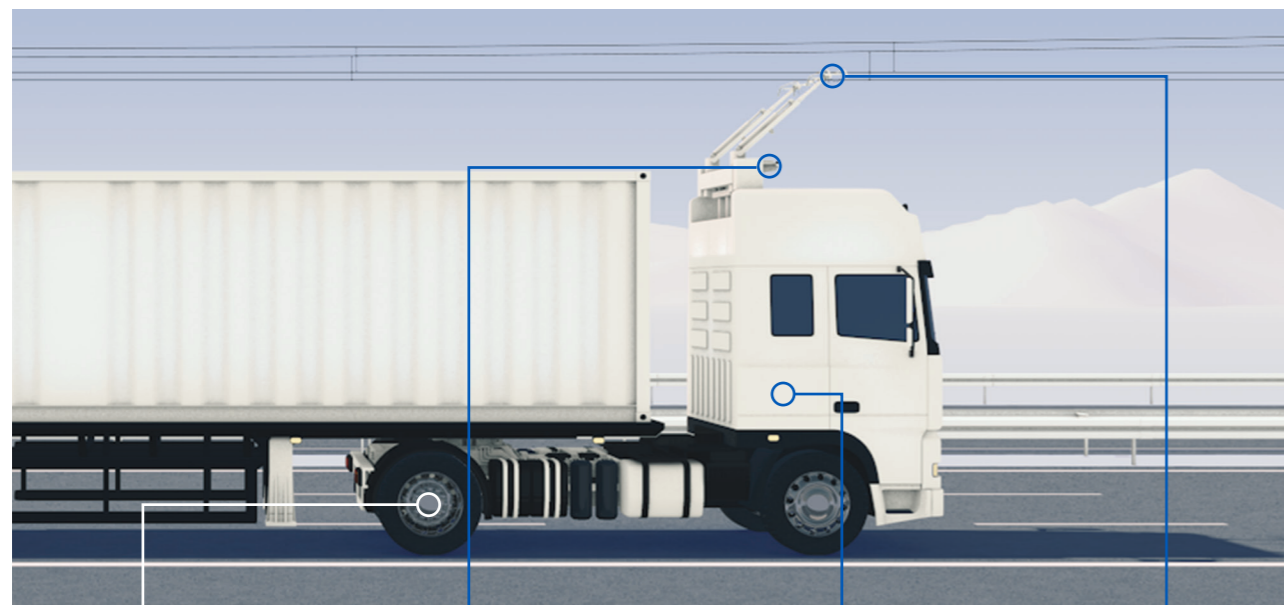
The eHighway technology: a combination of innovative infrastructure and advanced automotive engineering.

The catenary system provides energy via two overhead catenaries above each right-hand lane. When a catenary truck equipped with an electric motor and a battery reaches the catenary, the integrated current **collector** is extended and contact to the overhead catenary is established. The electric motor is supplied with electricity and the battery is charged simultaneously. As soon as the overhead catenary ends or the catenary truck starts to overtake, the battery takes over the power supply of the electric motor. This means that the power supply can be disconnected while the truck is moving without reducing its speed.

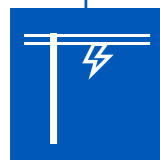
ELISA – Overall project management by Autobahn GmbH

- Monitoring of the safe operation of the roadside infrastructure of the eHighway system
- Responsibility for the evaluation from the road and catenary infrastructure operator's point of view
- Research of the expansion of the system
- Operation of the catenary system control centre at the Traffic Center Germany (*Verkehrszentrale Deutschland, VZD*)

75% less fuel consumption



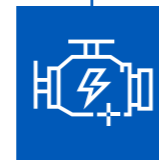
*Source: Siemens Mobility GmbH



Braking energy is returned



Sensors recognise the overhead catenary



Hybrid drive



Innovative current collector



Global CO₂ emissions as room volume

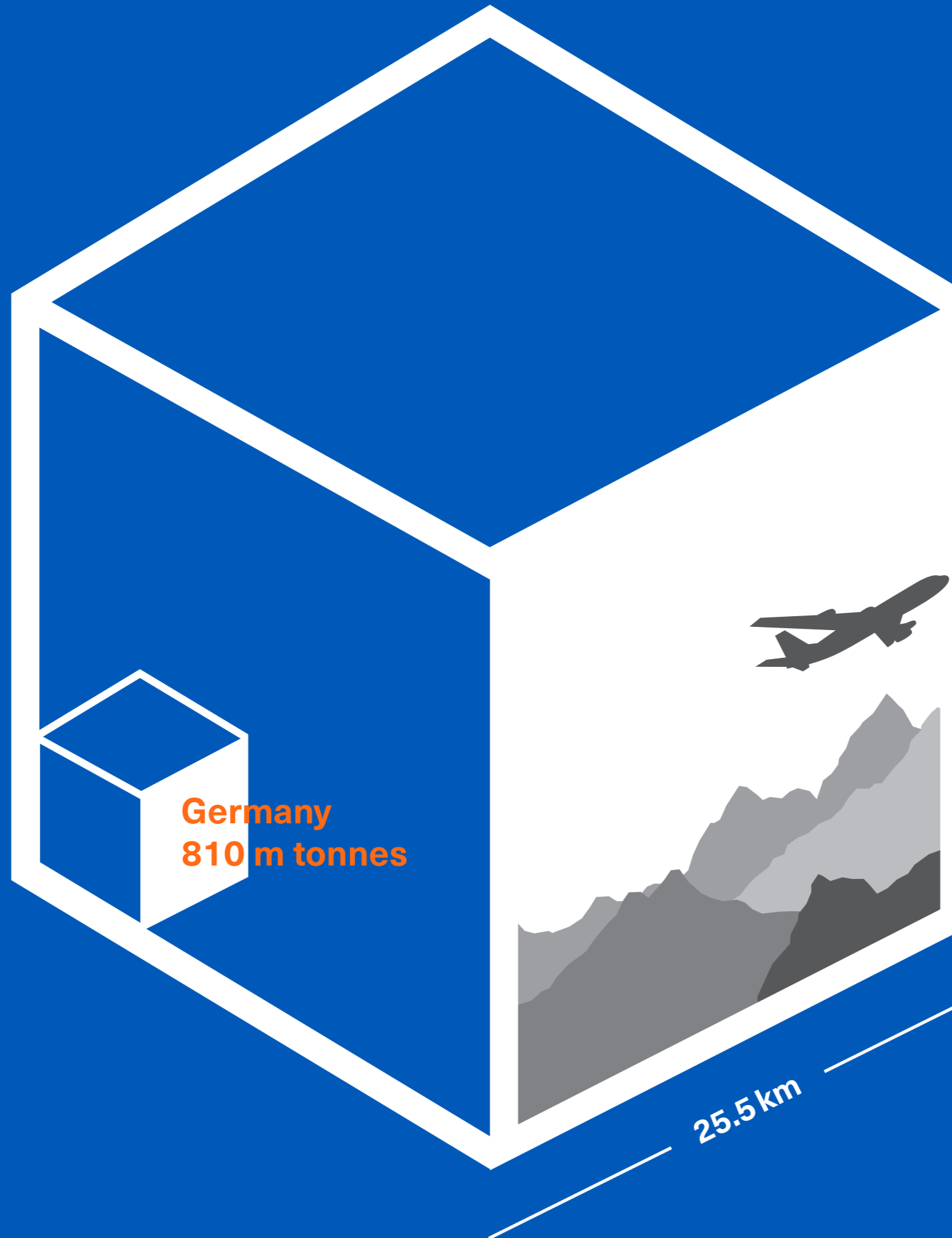
If you represent this quantity as spatial volume, you get a cube with an edge length of over 25.5 kilometres. It is almost **three times as high as the Mount Everest** and reaches into the Earth's ozone layer.

Global CO₂ emissions 2019:

36.4

gigatonnes

CO₂



Germany
810 m tonnes

20 km ozone layer

13 km cruising altitude of a passenger airplane

8,848 m Mount Everest

25.5 km

Germany 2019:

2.2%

of the global

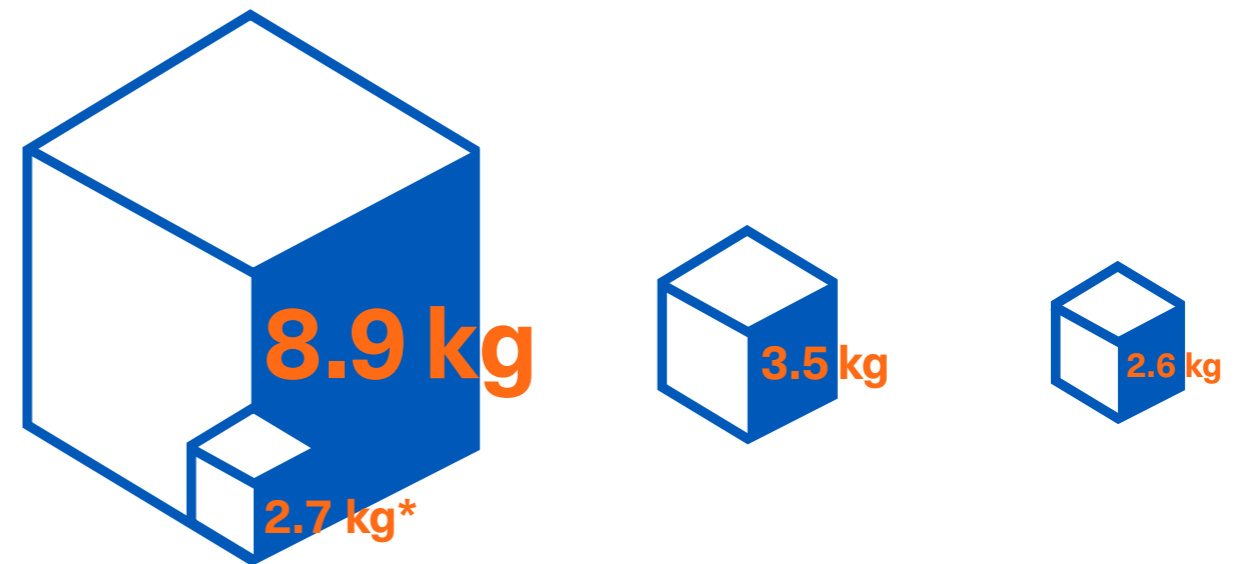
CO₂

emissions



My CO₂-contribution

Average CO₂ emissions (in kg per person)



Travel to work by car
* Travel to work without car

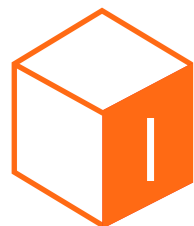
Production of one
portion of beef goulash

Trip of 10 km in
a small car

What can you do to save CO₂?

Write to us: elisa@autobahn.de
and read the articles on autobahn.de/ehighway

The ELISA field test until 2022



In the second phase of the ELISA project, the eHighway system will be tested over a period of four years until the end of 2022, both on the vehicle and infrastructure side.

To this end, the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety is initially providing five catenary trucks for the Hessian field test. These will be used by the logistics partners in their real transport processes.

The test track between Darmstadt and Frankfurt has officially been in operation since May 2019. A short time later, the first catenary hybrid truck used the track and now runs on the eHighway several times a day. The complete delivery of all five catenary hybrid trucks (by mid-2020) will provide the basis for a comprehensive evaluation.

In September 2021 the Federal Ministry of Transport and Digital Infrastructure introduced the so called "innovation cluster": A plan to promote climate neutral drive technologies for heavy goods vehicles. ELISA and the eHighway technology will be an integral part of that plan.

Since 2020 ELISA III

The goal of ELISA III is the extension of the current system on the A5. The section in the direction of Darmstadt will be extended by 7 kilometres. This way there will be two sections of different lengths, on which further research topics can be explored. That includes further steps towards market-readiness of the technology such as electrification of connection points or road sections with a noise protection wall. ELISA III will also see the introduction of additional research trucks to the project.

Project Partners

The federal **Autobahn GmbH** manages the overall project as project coordinator and, being the responsible road and infrastructure operator, is in charge of the safe operation of the roadside infrastructure of the eHighway system. Project partners are the **Institut für Verkehrsplanung und Verkehrstechnik der TU Darmstadt** (Institute of Transport Planning and Traffic Engineering of the Technical University of Darmstadt), **Siemens Mobility GmbH** and **ENTEKA AG**.

Transport partners

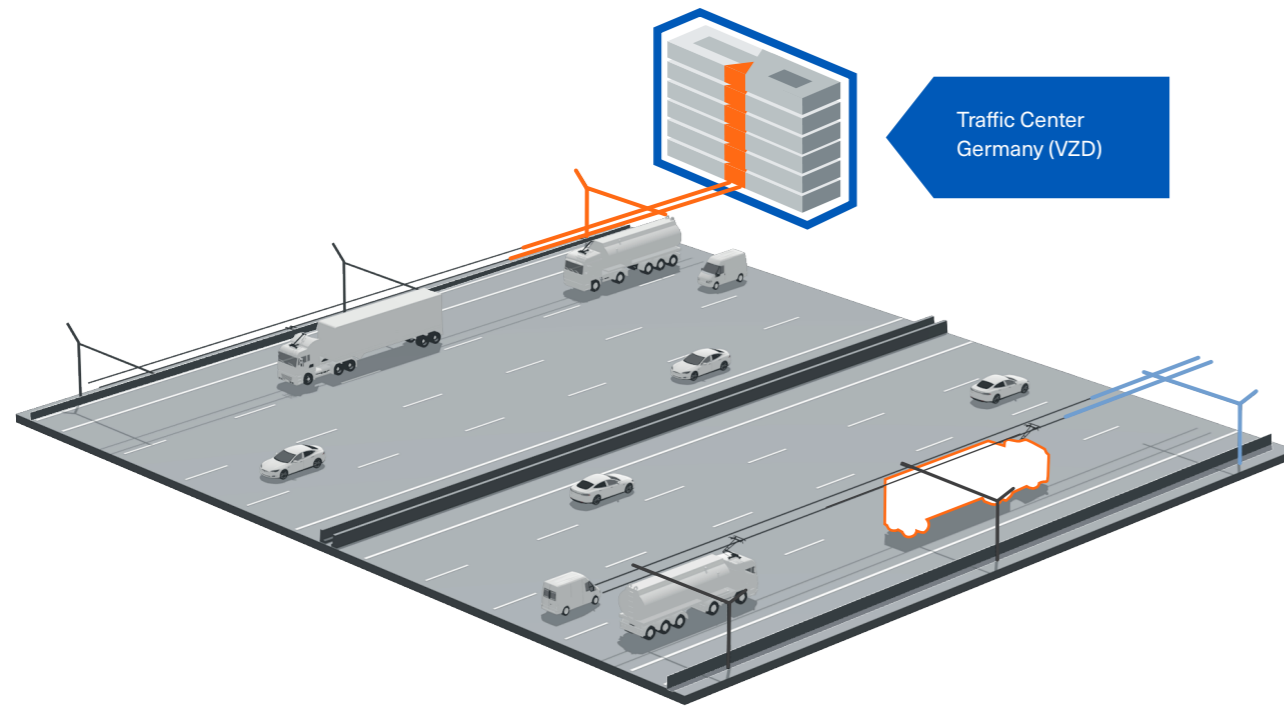
Various regional logistics companies have agreed to use at least one catenary truck each in their daily logistics processes, thus contributing to a successful pilot operation as associated partners.

These are:

Spedition Hans Adam Schanz GmbH & Co. KG
Ludwig Meyer GmbH & Co. KG
Contargo GmbH & Co. KG
Knauf Gips KG
Merck KGaA

eHighway system setup

The overall system and its subsystems in public road space under real traffic conditions.



- Traffic Engineering**
 - Traffic data collection
 - Vehicle data
 - Radio communication between vehicle and control centre
- Electric Control System**
 - Operation and control

- Vehicle**
 - Current collector
 - Drive
 - Energy storage
- Electrical installations**
 - Power supply
 - Catenary



By 2045
-78%
 (cf. 2020)

greenhouse gas emissions

with alternative drives

Electro-mobility
 incl. plug-in hybrids, range extender vehicles, motor vehicles and catenary trucks

Fuel-cell vehicles
 with hydrogen from regeneratively produced electricity

Combustion engines
 with liquid and gaseous fuels generated from electricity

ELISA project partners

For the success of the ELISA project, Autobahn GmbH, as in many other research and development projects, is counting on innovative and experienced regional partners who will contribute to the success of the overall project with their expertise.

Technical University of Darmstadt

The Institute of Transport Planning and Traffic Engineering (IVV), headed by Prof. Dr.-Ing Manfred Boltze, supports the field test with a comprehensive scientific evaluation. In ecological matters, the evaluation is supported by Prof. Dr. Liselotte Schebek (Department for Material Flow Management and Resource Economy). Substantiated answers are to be provided for questions that are already known today, but also those that arise during test operation. Based on these research results, reference documents will be produced which can serve as a basis for the decision on a later system expansion. In addition, the IVV maintains an exchange with other eHighway field tests, for example in Schleswig-Holstein and Baden-Württemberg, as well as with affected stakeholders, partners and interested parties.

Taking a critical look at the eHighway system in order to provide meaningful and substantiated answers to all questions



TECHNISCHE
UNIVERSITÄT
DARMSTADT

Siemens Mobility GmbH

Siemens Mobility GmbH is involved in the research and evaluation programme; it assesses and documents the knowledge gained from the system provider's perspective. In realistic test operations, the team checks the robustness of the pantograph system and identifies possible improvements. As the inventor of the eHighway system, Siemens Mobility GmbH provides general support for all questions concerning energy supply, automotive engineering and system integration.

Development of the eHighway from 2010

Siemens has been working on the technology since 2010. As part of the research projects ENUBA1 and 2 (electromobility in heavy commercial vehicles to reduce the environmental impact on densely populated areas), Siemens developed a concept for the electric, catenary-bound operation of heavy commercial vehicles in cooperation with Scania and tested its technical feasibility.

Half as much energy consumption and significantly less local air pollution.



Entega AG

ENTEAGA AG is working on energy technology issues as a project partner. Another task will be the development and application of an exemplary billing system as well as the creation of a billing-specific reference paper. It also supports the evaluation from the power company's perspective. During the pilot operation, ENTEAGA AG will also be available as a contact for all energy-related, and regulatory and legal questions. ENTEAGA AG, a municipal company headquartered in Darmstadt, provides energy and infrastructure services to the cities of Darmstadt and Mainz as well as the southern part of Hesse. With around 2,000 employees, it is one of eight large municipal energy service providers in Germany. Its subsidiary ENTEGA Energie supplies around 2.67 terrawatt hours of green electricity and 2.18 terrawatt hours of climate-neutral natural gas to its customers each year. This makes it one of the largest suppliers of climate-neutral energies.

**Sustainable energy supply:
Avoiding, reducing and compensating CO₂**



Transport partners

Various regional logistics companies have agreed to use at least one catenary truck each in their daily logistics processes.

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Knauf Gips KG

Merck KgaA

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Into the future with ELISA

Contact

Die Autobahn GmbH des Bundes
Phone: +49 (0) 69 743057 0
E-Mail: elisa@autobahn.de

autobahn.de

