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Transport infrastructure: beyond rail and road

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Comparisons of greenhouse gas (GHG) balances of different means of transport are mostly limited to emissions, which are caused by the operation of the vehicles concerned – in effect, the direct emissions from the combustion of fuel (e.g. petrol, diesel, kerosene) in the vehicles and the indirect energy-related emissions caused by the generation, conversion, distribution and supply of the energy sources.

Raw materials like concrete, steel and copper that are used in the construction of transport infrastructure and the vehicles themselves have often been left out of GHG balances. A comprehensive analysis of the environmental impacts of different modes of transport, however, should not only consider the emissions of the energy sources used, but also emissions arising from vehicle manufacture and infrastructural needs.

Research projects on transport infrastructure

Alongside a comprehensive and up-to-date comparison of different modes of transport requiring transport infrastructure, researchers at Oeko-Institut are also focusing, in several current research projects, on the possible future design of transport infrastructure and the question of how to establish a transport infrastructure that is fit for the future.

The following problems are at the centre of Oeko-Institut's research in this field: the high demand for resources needed by transport infrastructure; secondary raw materials that can be used in road construction; changing framework conditions such as the influence of demographic change, the influence of climate change and climate protection measures and the costs of different infrastructure systems. Furthermore, the researchers are also examining the demands on the energy supply infrastructure for the transport sector which have changed as a result of new drive technologies.

Comprehensive GHG balance of road, rail and air transport and shipping

How environmentally friendly is a journey by rail compared to a journey by motorway or air? What share does the use of modes of transport have compared to infrastructure such as that for roads, rail and airports? What would the results of an integrated sustainability impact assessment of different means of transport be?

One of Oeko-Institut's current research projects compares the GHG emissions of different means of transport and aims to answer these questions. The analysis – conducted on behalf of the German Federal Environment Agency – arrives at the conclusion that the construction of infrastructure and vehicles accounts for approx. 10-30 % in the GHG balance of road, rail, air and shipping transport. As a result, the researchers found that rail and coach are still the most environmentally friendly means of passenger transport, even when the construction of roads, airports, rail etc. is included in the overall GHG balance.

Specific focus on GHG emissions of transport

The incorporation of the transport infrastructure and vehicle manufacture in the overall GHG balance and the focus on the kilometres / tonne kilometres travelled in freight transport results in a comprehensive and differentiated overview of the specific greenhouse gas emissions. For example: Travelling long distances by car produces the highest GHG emissions at 166 grams of CO₂-equivalent (CO₂e) per kilometre; approx. 20 grams originate from infrastructure and the vehicles.

Rail transport has the largest share of infrastructure- and vehicle-related emissions at approx. 20 grams of CO₂e, but its overall emissions (approx. 71 grams) are 57 per cent below those of passenger cars. In terms of air transport (domestic flights within Germany), 27 grams of CO₂e of alone is caused by the construction and operation of vehicles and infrastructure and overall 260 grams arises per kilometre flown. The operation of airports alone makes up approx. eight per cent of the emissions.

The Oeko-Institut's report "Greenhouse gas emissions caused by the infrastructure and vehicles of road, rail and air transport and shipping in Germany" (in German) is available here:

<https://www.umweltbundesamt.de/publikationen/treibhausgas-emissionen-durch-infrastruktur>

A Background paper "Comparison of the greenhouse gas emissions of road, rail and air transport" (in German) is available here: <http://www.oeko.de/uploads/oeko/oekodoc/1853/2014-001-de.pdf>

Furthermore the project report on Oeko-Institut's project "Greenhouse gas emissions caused by rail infrastructure and rolling stock in Germany" (in German) is available here:

<http://www.oeko.de/uploads/oeko/oekodoc/1852/2013-520-de.pdf>