

Policy Brief

NET-ZERO-CARBON TRANSPORT IN EUROPE UNTIL 2050 – TARGETS, TECHNOLOGIES AND POLICIES FOR A LONG-TERM EU STRATEGY

Background and Motivation

The European Union (EU) is committed to the ambitious target of climate neutrality by 2050, to keeping global warming well below 2°C, and to making efforts to limit it to 1.5°C. The long-term target of climate neutrality and the ambition of the Paris Agreement imply climate-neutral transport by 2050 unless large-scale negative emissions in other sectors are assumed. Transport is currently responsible for about one quarter of energy-related greenhouse gas (GHG) emissions in the EU.

The recent European agreement to reduce GHG emissions by 55 % until 2030 (compared to 1990 emission levels) and the Green New Deal make a reconsideration of EU transport policies very timely. Furthermore, the European Commission published its Sustainable and Smart Mobility Strategy in December 2020 (EC 2020) and the year 2021 will see new legislative proposals to meet the more increased –55 % target for GHG emissions in 2030 (compared to 1990). Most importantly for transport, both the CO₂ fleet targets for newly sold passenger cars for 2030 and

the alternative fuel infrastructure directive (AFID) will be reviewed or revised in 2021. The current year thus provides a unique opportunity to re-think and realign European transport policies to meet the EU's contribution to the Paris Agreement.

The present policy brief derives domestic transport emission budgets for the EU-27 until 2050 and presents implications for transport policies in Europe.

Main Findings

A Paris compatible greenhouse gas budget for Europe requires zero carbon transport before 2050. Domestic emission budgets for energy- and process-related GHG emissions of the EU-27 in line with 1.5°C of global warming indicate further 37 – 44 Gt CO₂eq. can be emitted. Deriving a share for transport either based on abatement costs or on transport's current share in greenhouse gas emissions leads to 10.2 – 12.1 Gt CO₂eq., where the range depends on whether limited overshoot of the 1.5°C target is allowed or not. Current GHG emissions from transport in Europe are 0.9 Gt CO₂eq. annually (excluding

Fraunhofer Institute for Systems and Innovation Research ISI

Breslauer Straße 48
76139 Karlsruhe

Dr. Patrick Plötz
Coordinator of Business Unit
Energy Economy
patrick.ploetz@isi.fraunhofer.de

www.isi.fraunhofer.de

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TRANSPORT EMISSIONS [Gt CO₂eq]

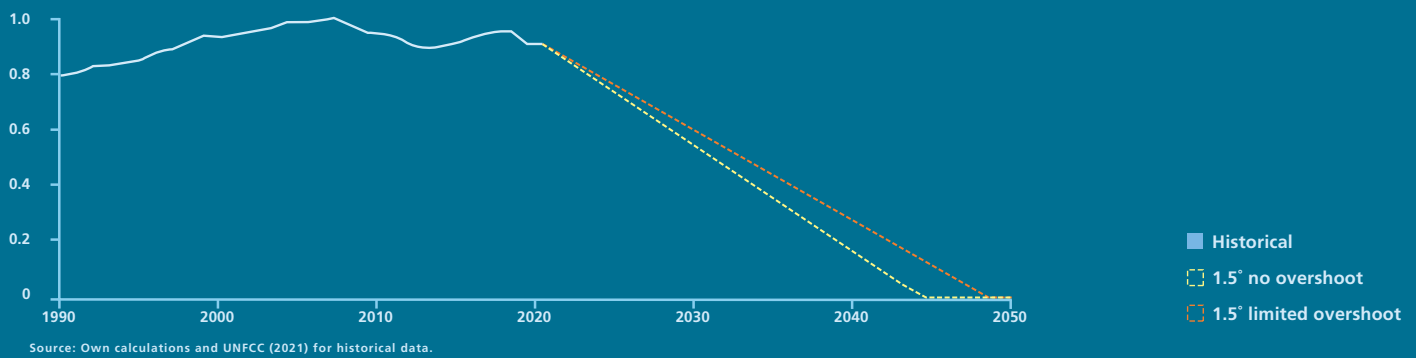


Figure 1. Historical and required future transport GHG emissions within 1.5°C emission budgets.

international bunkers for international navigation and aviation). At current annual emissions, Europe's transport carbon budget would be used up in 11 – 13 years and all further emissions would contribute to global warming permanently above 1.5°C.

The EU is not on track for zero carbon transport consistent with the Paris agreement. To remain within the GHG emission budget, transport emissions have to be reduced by 36 – 42 % from current levels until 2030 (or 41 – 47 % compared to 2005) and go to zero until 2044 – 2048, if a linear emission reduction path is assumed. The more ambitious reduction path is for a scenario without overshoot of the 1.5°C target and the less ambitious scenario with limited overshoot. For 2030, this linear reduction path is consistent with Europe's current goal of –55 % in total GHG emissions until in 2030 (compared to 1990 levels), if a similar reduction level is assumed for transport. However, the current EU sustainable mobility strategy aims at 90 % GHG emission reduction from today's levels until 2050 (compared to today) whereas a 1.5°C carbon budget for transport requires a 90 % reduction already until 2042 – 2045. The historical emissions since 1990 and the two linear reduction paths are shown in figure 1 above. The required percentage emission reductions are summarised in table 1.

Net-zero carbon transport before 2050 is feasible but existing policies need to be tightened. Several studies have already discussed the path to net-zero carbon transport until 2050. The current fast market uptake of plug-in electric vehicles and the statements of major global vehicle manufacturers to phase out combustion engine sales in cars until 2035 and in trucks until 2040 show that a fast transition in road transport is possible. Policy makers can seize the current momentum to tighten existing CO₂ fleet targets for passenger cars and trucks. High speed rail and night trains offer the possibility to reduce future demand growth in aviation and rail transport is already mostly electrified. Yet, additional action is needed to achieve zero carbon aviation and shipping. Demand reduction and sustainable zero carbon fuels are the main options that should be quickly implemented.

CO₂ fleet targets for passenger cars and trucks need to be much more ambitious. For passenger cars, the 2030 targets are reviewed this year and a reduction of 80 % until 2030 compared to 2021 as well as a transition to 0 gCO₂/km for cars no later than 2033 are consistent with a 1.5°C carbon budget for transport. Several major European manufacturers have already announced that more than two third of the newly sold vehicles will be electric in 2030. For trucks, the currently required 30 % reduction until 2030 is too slow as the slow stock turnover requires a 100 % reduction target for newly sold trucks already in 2034 or 2038 (depending on the state of zero carbon fuels and the possibility of temporal overshoot). Accordingly, a 55 – 67 % reduction until 2030 for newly trucks would be needed. This appears possible as many technical options for energy efficiency

Scenario	1.5° no overshoot			1.5° limited overshoot		
	1990	2005	2020	1990	2005	2020
2030	–34 %	–47 %	–42 %	–27 %	–41 %	–36 %
2035	–58 %	–66 %	–63 %	–48 %	–57 %	–54 %
2040	–82 %	–86 %	–84 %	–68 %	–74 %	–72 %
2045	–100 %	–100 %	–100 %	–88 %	–90 %	–90 %
2050	–100 %	–100 %	–100 %	–100 %	–100 %	–100 %

Table 1. Percentage change of transport GHG emissions for linear emission reduction.

improvements are available, e.g. for diesel engines, tires, and aerodynamics, as well as a fast transition to zero-emission trucks (the manufacturers have announced the target of 100 % ZEV trucks in sales by 2040).

Infrastructure and low-carbon fuel policies support the transition in road transport and reduce GHG emission from combustion engines. Fast infrastructure roll out for electric cars and alternative fuel trucks are required. The existing AFID offers a suitable framework and should set ambitious infrastructure targets for the EU Member States for electrification of both light and heavy-duty vehicles. Ambitious low-carbon fuel standards will reduce the emissions of the remaining combustion engine vehicle fleet.

New policies can accelerate the uptake of electric vehicles and ensure emission reduction of vehicles with combustion engines. A high share of zero-emission vehicles (ZEVs) allows highly emitting conventional vehicles (both cars and trucks) to enter the market and emit more CO₂ than expected from the fleet reduction targets. Ideally, a CO₂ emission reduction of newly sold combustion vehicles and the market uptake of ZEVs take place simultaneously in the next decade as the efficiency of both electric or combustion engine vehicles is relevant. The combination of CO₂ fleet targets purely for combustion engine vehicles and ZEV mandates, i.e. fixed ZEV sales quotas for vehicle manufacturers offers this possibility. Such an approach is already laid out in the Chinese dual-credit policy as well as in the Californian ZEV mandates. The EU should carefully assess the benefits and draw backs of such a policy combination in Europe.

Pricing and mode shift can support the transition to zero carbon transport. Deep GHG emission reduction targets can be supported by a shift to low-carbon modes and by travel demand reduction. Carbon pricing can play an important role in both aspects as high road transport prices reduce car and truck travel activity and make train and

active travel by foot and bike more attractive. Likewise, high taxation and carbon prices for aviation could shift transport to more sustainable high-speed and night trains. The existing targets for tripling passenger rail transport and doubling rail freight transport until 2050 are strong indicators for Europe's ambitious commitment to shift transport from road and air to railways. Infrastructure roll-out, a comprehensive night train network and strong pricing policies need to support this shift to the more sustainable rail transport.

A transition to sustainable zero carbon fuels is needed for aviation and navigation. Direct electrification of aviation and navigation even for domestic European transport is very unlikely in large stock shares until mid of the century for aviation and navigation despite already existing small scale electric ferries and first electric and hydrogen plane concepts. Strong carbon pricing can reduce additional growth of future travel activity and the introduction of quotas for sustainable zero carbon fuels allows a step-by-step pathway to carbon neutral navigation and aviation. However, more research is required on how to tackle non-CO₂ global warming effects of aviation in high altitudes.

Elements of a Policy Roadmap for a Future Low Carbon Transport Policy Mix in Europe

The following points can provide guidelines for designing a policy mix that fosters zero-carbon transport in line with Europe's commitment towards zero carbon transport that is compatible with Europe's commitment to the Paris Agreement, i.e. to pursue efforts to limit global warming to 1.5°C.

1. CO₂ fleet targets for newly sold cars in Europe have to be much more ambitious. An 80 % reduction of the average emissions of newly sold vehicles until 2030 compared to 2021 is needed as well as a target of 0 gCO₂/km for cars no later than 2033. Similar targets hold for light-duty vehicles.

2. CO₂ fleet targets for trucks need to be tightened. A 55 – 67 % reduction until 2030 compared to 2020 for newly trucks is needed followed by a 100 % reduction target for newly sold trucks already in 2034 – 2038.

3. Infrastructure for alternative fuel vehicles is required for a fast and successful transition to 100 % ZEV in cars and trucks. An ambitious and joint European standards are needed for fast charging of electric cars and trucks. The role of fuel cell vehicles in road transport is still uncertain and requires adaptive planning and policies.

4. Aviation and Navigation require sustainable zero carbon fuels. This transition can be ensured by introducing **quotas for sustainable zero carbon fuels** that start as soon as possible and reach 100 % by 2044 – 2048, compatible with the linear reduction path of a 1.5°C GHG emission budget for Europe.

5. Carbon pricing, e.g. via taxation or an emission trading scheme in transport, can support the shift to low-carbon modes such as rail, public transit or bike, but will not alone deliver deep GHG emission reductions and should be seen as complement and not as substitute to ambitious CO₂ fleet targets and quotas.

Publication details

Title

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Authors

Patrick Plötz, Jakob Wachsmuth, Till Gnann, Felix Neuner, Daniel Speth, Steffen Link

Contact

Dr. Patrick Plötz
patrick.ploetz@isi.fraunhofer.de