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SELECTED HIGH-IMPACT MEASURES

# Low-Carbon Transport Policies for Ukraine

by Alexander Roth

Low Carbon Ukraine

Implemented by Berlin Economics

Supported by: Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

based on a decision of the German Bundestag

# Motivation and project background

This policy proposal is part of a series which was elaborated in the framework of the project Low Carbon Ukraine (LCU) supporting more ambitious paths for selected energy and climate policy areas.

The idea to develop the present ten “Policy Proposals” arose in the course of LCU’s support for the Ministry of Energy of Ukraine in setting up a National Energy and Climate Plan for Ukraine. While Ukraine’s climate targets are partially very ambitious, we often observed a lack of underlying analysis and concrete policy measures to achieve those targets. For the most crucial topics, we provide a comprehensive analysis and propose concrete policy measures based on international experience.

Each Policy Proposal was written in a multi-stage process: a first draft of LCU experts or invited professionals was discussed over summer and early autumn 2020 with Ukrainian experts and stakeholders. Results of those discussions were taken into account when updating the Policy Proposals. It is important to note, that the presented results reflect the view of the authors and not necessarily the position of the BMU (Federal Ministry for the Environment, Nature Conservation and Nuclear Safety).

We hope that the present analysis and proposals will contribute to a fruitful and constructive discussion and help Ukraine to develop ambitious, yet realistic energy and climate policies.

Dr. Georg Zachmann, project leader
Ina Rumiantseva, project manager

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Low Carbon Ukraine is a project with the mission to continuously support the Ukrainian government with demand-driven analysis and policy proposals to promote the transition towards a low-carbon economy. It is part of the International Climate Initiative (IKI) and is funded by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) on the basis of a decision adopted by the German Bundestag. The project is implemented by BE Berlin Economics GmbH.

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# Executive summary

Ukraine's greenhouse gas (GHG) emission from transport saw a strong decline in the 1990 and have been slightly increasing since the year 2000. While the economic contraction was largely responsible for past emission decreases, Ukraine needs a set of policies to actively steer the transport sector towards a low-carbon future. Despite economic challenges, we argue that Ukraine is in a good position to further decrease transport emissions and to reach its long-term climate goals. Ukrainian policymakers should focus on developing an integrated strategy that connects road, rail, and aviation. Especially the transport sector deserves holistic thinking: while different levels of governance and governments have to coordinate vertically, the decarbonization of the transport sector must be thought together horizontally with the decarbonisation of other sectors. Without a low-carbon electricity sector, many policies for the transport sector will fail.

Although Ukraine can build on an already good efficiency level of new cars and trucks, it should think about introducing its own $CO_2$ emission targets for vehicles. Crucially, policies aiming to upgrade the old and inefficient stock of cars and trucks should be introduced. In the context of a sustainable development, Ukraine's low rate of motorisation should be seen as an asset rather than a deficiency, helping to avoid building a car-centred mobility system. Importantly, Ukrainian policymakers should push for alternative modes of transportation, especially in the cities. Local public transport must be improved, active modes of transportation, such as walking and cycling, strengthened, and cars more efficiently used. Although emissions from domestic aviation are still small, they have been increasing in recent years. Instead of investing into new air-related infrastructure, investment should be primarily targeted to railway. Railway has a key part to play when it comes to decrease emissions from domestic flights, long-haul car travels, and freight transportation.

Crucially, transport policies for Ukraine need to be designed to provide new modes of transportation for citizens and to improve their quality of life. Policies need to be socially just, so they are attainable for citizens and politically feasible. Transport policies must be designed in an integrative way: for instance, pricing of traffic will only successful when adequate transport alternatives exist for citizens. If done correctly, various transport policies offer possibilities for economic development and will generate several co-benefits, such as lower levels of pollution, traffic, and noise. With the right policies, Ukraine can achieve to further decrease transport emissions and reach its mid- and long-term climate goals. Ukrainian policymakers will in due time need to take decisions towards this direction so that harmful trends, such as an over-reliance on cars, can be avoided from their beginning.

# Introduction

Many researchers regard the transport sector as rather difficult to decarbonise. The reliance on fossil fuels, the persistence of demand (thus the ineffectiveness of taxes) (Pietzcker *et al.*, 2014) as well as lock-in effects and a fragmented governance (Banister *et al.*, 2011) are often given as reasons. Viable solutions are being complicated by the multitude of actors as well as interactions with other sectors and fields. To reach a low-carbon transport future, Ukrainian policymakers will have to take the right political and economic decisions now. Ukraine must avoid getting locked in a carbon-intensive transport infrastructure, which will be costly to change in the future. Instead of suggesting isolated measures, we argue in favour of a comprehensive strategy. As described by Banister *et al.* (2011), the transport sector is multifaceted, making it necessary to coordinate small and targeted measures for individual measures under a wider strategy.

*Transport sectors are difficult to decarbonize due to lock-in effects and a fragmented governance.*

This policy report serves several goals: First, it aims to inform the reader about the latest state of GHG emission of the Ukrainian transport sector as well as its main transportation trends. Second, it sheds light on some of the most important policy developments in the European Union that could serve as inspiration to Ukraine. Finally, it discusses different transport policies that could be developed in Ukraine.

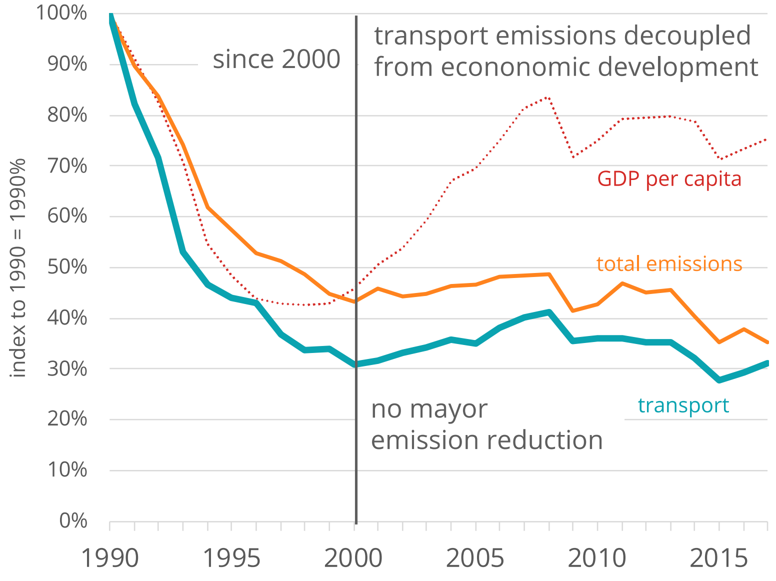
*A carbon-intensive transport infrastructure can be avoided with a comprehensive strategy.*

# Overview emissions

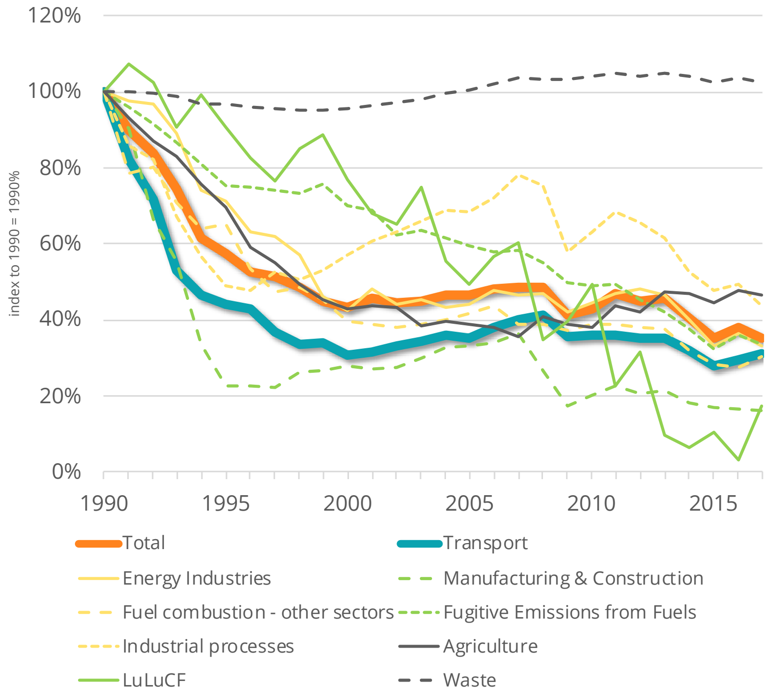
Ukraine's transport sector and its emissions are still shaped by the drastic changes the country underwent during the last 30 years. The collapse of the economy in the 1990s resulted in a strong decrease of demand for transport and thus emissions. Ukraine's transport sector reduced its yearly GHG emission by 70% between 1990 and 2017. Figure 1 provides an overview of past emissions per sector (relative to 1990) and highlights the similarity of reductions between the sectors (except for "waste"). Like most sectors of the Ukrainian economy, reductions occurred during the contraction of the Ukrainian economy in the 1990s (see the drawn line "GDP per capita"). Emissions from transport stabilized around the year 2000 and have been decoupling from the further economic development since then, yet no mayor emission reduction has been achieved since 2000.

*Ukraine's transport sector reduced its yearly GHG emission by 70% between 1990 and 2017.*

**Figure 1: GHG emissions per sector (relative to 1990)**



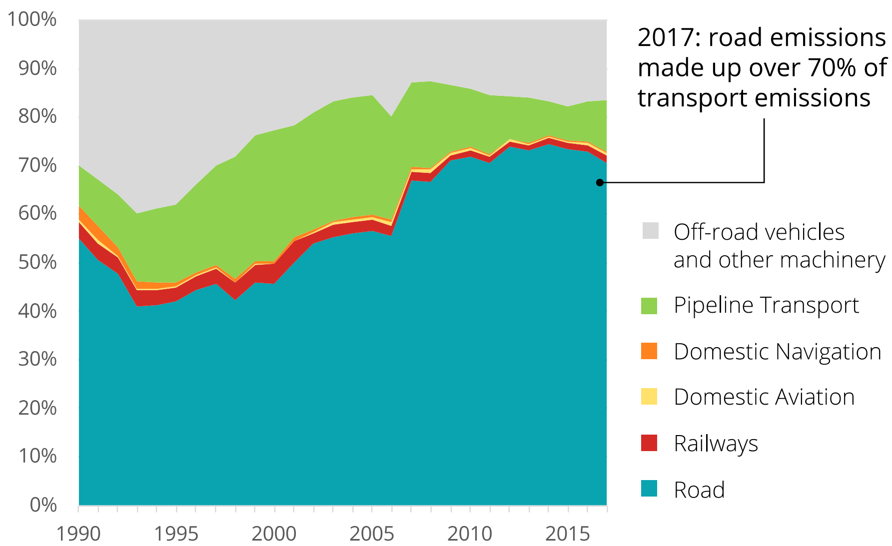

*Notes: GDP per capita in purchasing power parity (PPP) (constant 2017 international USD)*




Source: UNFCCC (2020); World Bank (2020)

While transport emissions fell from 112 Megatons $CO_2$ equivalent (Mt $CO_2$-eq) in 1990 to 35 Mt $CO_2$-eq in 2017[1], their share in overall emissions remained about constant. Currently, Ukrainian transport sector emits about 10% of all GHG emission, but accounts for 71% of total Ukrainian oil consumption in 2018[1] (Ukrstat, 2020a). The composition of emissions changed markedly over the past three decades. The most pronounced change is the increasing share of road vehicle emissions (Figure 2). In 2017, road emissions were responsible for over 70% of all transport emissions, making it the most important issue to tackle for future transport policies.

**Figure 2: GHG emissions of the transport sector (in shares)**




Source: UNFCCC (2020)

[1] Latest numbers available.

Overall, transport emissions are still a minor issue in Ukraine as compared to other countries. However, if the trends from the EU are of any guidance – increasing car ownership for example – there is a risk that wrong strategic choices today could make transport emission a problematic issue in the future.

## Road emission

With a share of over 70%, road emissions are the largest contributor to Ukrainian transport emissions. According to latest numbers (2015) by the International Organization of Motor Vehicle Manufacturers (OICA, 2020), Ukraine's vehicle fleet consists of around 9.1 million vehicles, of which 7.4 million are passenger cars and 1.7 million commercial vehicles (light and heavy duty trucks and buses)[2]. However, two reports (Hill & Klimenko, 2016; The State Enterprise 'State Road Transport Research Institute' & Institute of Engineering Ecology, Ltd, 2017) point out that those fleet numbers are most likely too high because official numbers do not properly account for scrapping of old cars. For 2014, Hill & Klimenko (2016) report an entire vehicle fleet of 4.6 million vehicles consisting of 3.7 million passenger cars, 766,000 trucks, and 105,000 buses[3]. The large discrepancy of fleet sizes between different sources also calls for an improvement of data management and publication so that independent researchers can work with reliable data.

*With a share of over 70%, road emissions are the largest contributor to Ukrainian transport emissions.*

Ukraine's level of motorization is low compared to other countries. In 2015, Ukraine had 164 passenger cars per 1000 inhabitants, which is less then direct neighbours such as Russia with 308 and Hungary with 325 and more prosperous countries such as Germany with 552 and Italy with 614 (Figure 3). As for commercial vehicles, Ukraine has a rate of 38 per 1000 inhabitants which makes it also the lowest in the abovementioned group of countries, however, the differences are much smaller. Overall, we see that between 2005 and 2015 (almost) all countries had growing rates of motorisation, especially with regard to passenger cars. The growth was particularly strong in Russia (79%) and Ukraine (39%). These motorization rates are based on OICA (2020) numbers to allow for cross-country comparison. As mentioned above, these figures are called into question and when using data by e.g. Hill & Klimenko (2016), motorization rates would be lower for Ukraine. These varying data, however, do not alter our subsequent policy recommendations.

*The level of motorization is low compared to other countries.*

A prominent issue is the age of Ukraine's vehicle fleet. Reliable and good data are hard to obtain. Yet, the report by Global Fuel Economy Initiative in Ukraine (2018) lists an average age of the Ukrainian vehicle fleet of around 19 years (in 2015). Unfortunately, we were not able to obtain disaggregated age data for CARS and trucks separately. The age of the fleet is an indicator for its low efficiency with respect to $CO_2$ emissions and other pollutants. For the entire fleet (2014 data), Hill & Klimenko (2016) reports that over 65% of vehicles cycling in Ukraine are of Euro-3 standard or older, while around 30% of the fleet have Euro-4. Less than 5% of the fleet are Euro-5 vehicles. We expect that these numbers have improved since 2014, however they show the age and efficiency problem of the Ukrainian fleet.

*Vehicle fleet has a high average age.*

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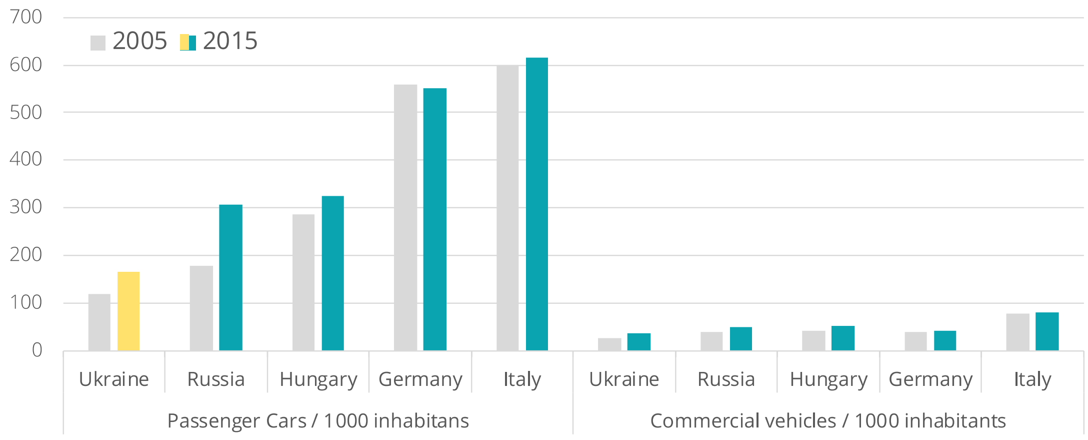
[2]The numbers by OICA (2020) are roughly equal to the ones stated by the Ukrainian Ministry of Infrastructure (without date) (Ministry of Infrastructure of Ukraine, n.d.). Global Fuel Economy Initiative in Ukraine (2018) cites the same numbers: 9.2 million vehicles in total, out of which 6.9 million passenger cars, 1.3 million trucks, 840,000 motorcycles and 250,000 buses. In contrast, numbers by the European Automobile Manufacturers Association (ACEA, 2018) are consistently higher (for Ukraine as well as other countries): for 2015, they report 12.7 million vehicles in total, out of which 9.6 million vehicles are passenger cars, 3 million are trucks (light and heavy), and 150,000 are buses.

[3] These numbers coincide broadly with those of the report by The State Enterprise 'State Road Transport Research Institute' & Institute of Engineering Ecology, Ltd, (2017)

**Figure 3: Motorisation in selected countries (units per 1000 inhabitants)**

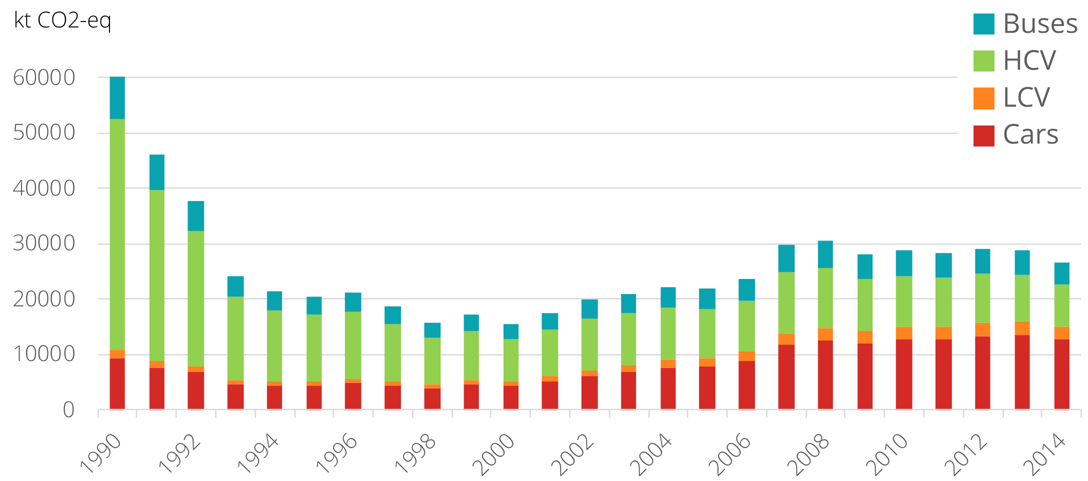



Source: OICA (2020); World Bank (2020)

*Passengers cars emit half of all road emissions, increasing their share strongly since 1990.*

The assessment of road emissions is complicated due to the lack of detailed data. Ukraine only reports partially disaggregated road emission data to the UNFCCC. Using those data, we are not in a position to analyse separately the importance of subgroups on road emissions: passenger cars, light-duty commercial vehicles[4] (LCV), heavy-duty commercial vehicles[5] (HCV), and buses. Fortunately, other sources (Hill & Klimenko, 2016) report disaggregated shares for at least certain years. According to that report, passenger cars emitted half of all road emission (48%) in 2014 (latest data available), while HCVs emitted 29%, buses 14%, and LCVs 10%. Since 1990, passenger cars strongly increased their emission share, while the share of LCVs only increased slightly. Emissions of HCVs have lost some of its importance, yet they still hold the second-largest share of road emissions in 2014 (Figure 4).

**Figure 4: Road emissions**




*Notes: Absolute emissions are based on total road emissions and emission shares; share values for the years 1990, 2000, 2010, 2014 are taken from Hill & Klimenko (2016), remaining share values are interpolated.*

Source: Hill & Klimenko (2016); UNFCCC (2020)

[4] Commercial vehicles (trucks) with a weight of less than 3.5 tonnes

[5] Commercial vehicles (trucks) with a weight of more than 3.5 tonnes

Looking at the more recent period, we see that road emissions rose by 70% between 2000 and 2014. In the same period, car emissions increased by 190%, LCV emissions by 234%, buses emissions by 39%, while HCV emissions dropped by 1%. Despite the fall of emissions in 1990s, these short-term trends call for action to limit the further increase of road emissions and to provide solutions for their long-term.

# Policy Fields

This chapter discusses four different "policy fields" we identified as especially relevant. For each field, we start with a brief analytical part by highlighting the most important facts. Subsequently, we propose and discuss different policy options for that field. Because of the overarching importance, we discuss "passenger cars" separately (section I), as urban and non-urban emissions are both affected. The remaining policy fields "urban traffic", "freight", and "long-haul transportation" are structured around their functions and not around specific modes of transportation to emphasise the holistic approach of transport policy we put forward.

## I. Passenger Cars

### a. Analysis

#### Car fleet

Currently, Ukraine's passenger car fleet contains around 7.4 million vehicles (OICA, 2020). However, due to missing mandatory technical inspection, numbers have to be interpreted with caution as the official registration system fails to properly account for scrapped or obsolete vehicles (Global Fuel Economy Initiative in Ukraine, 2018). As said before, figures for the entire fleet (not only passenger cars) may indicate that Ukraine has a problem with an old and inefficient car fleet.

Used cars play a significant role in Ukraine. While the share of used cars among the newly registered vehicles has been decreasing recently, those still account for 40% of new car registrations. Around two thirds of newly registered used cars are less than 4 years old, yet a third is still older than 5 years (Global Fuel Economy Initiative in Ukraine, 2018). In addition to used cars, Ukraine's car fleet also has a large share of foreign registered cars. As of January 2018, more than 400,000 foreign registered cars (Global Fuel Economy Initiative in Ukraine, 2018) were driven in Ukraine, accounting for a substantial share of the entire car passenger fleet. Other sources even report total numbers of up 1 to 2 million (Holubeva, 2020). Due to their age (often 15 years and older) they are a major problem when it comes to reducing emissions in the Ukrainian car fleet.

*Used cars play a significant role and still account for 40% of new car registrations.*

Regarding electrification of the fleet, electric car sales have seen an uptake in recent years in Ukraine. In 2014, only 62 electric cars were sold (share of 0.07%), yet this number has increased to 1,148 cars (share of 1.5%) in 2016 (Global Fuel Economy Initiative in Ukraine, 2018) and further to 7,012 vehicles in 2019 (112 Ukraine, 2020). Thus, Ukraine is in the top 12 of European countries by total amount of electric vehicles and shows one of the highest growth rates (IRS Group, 2019).

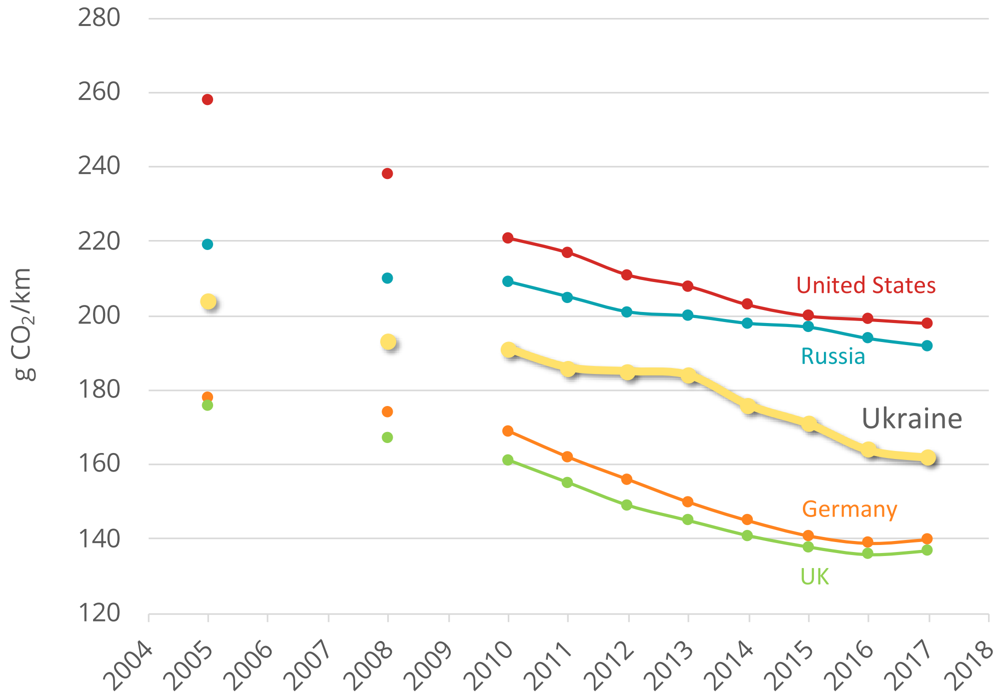
*Sales of electric cars have seen a recent increase.*

#### $CO_2$ efficiency

$CO_2$ efficiency of new firstly registered cars has improved in recent years in Ukraine. $CO_2$ emissions of per kilometre of new cars were around 160 g/km in 2017, which makes Ukraine ranking above countries like Germany and the UK, but below neighbours such as Russia and other advanced economies such as the US (Figure 5) (IEA, 2019a, 2019b).

*$CO_2$ efficiency of new firstly registered cars has improved in recent years.*

**Figure 5: Emissions of newly registered passenger cars**




Source: IEA (2019a; 2019b)

Regarding the emissions of the existing fleet, a recent report (The State Enterprise 'State Road Transport Research Institute' & Institute of Engineering Ecology, Ltd, 2017) shows that the average fuel consumption of the passenger car fleet has also been decreasing, thus $CO_2$ efficiency has been increasing (yet with differences between gasoline and diesel cars).[6]

## b. Policy recommendations

*The role of cars should be limited for the future Ukranian transport model.*

Instead of opting for a car-centred mobility model followed by many European countries, Ukraine should aim to progress to a sustainable transport sector in which cars are only one means of transportation besides many others. The still low level of motorization offers Ukraine the opportunity to directly move to a sustainable mobility model. Public transport (chapter II) has to play a strong role, which is complimented by an efficient fleet of passenger cars. Even an overreliance on a fleet of electric cars only would go hand in hand with problems such as high energy usage, loss of public space, and ultimately congestion. A more effective car taxation, mainly guided by actual emissions, could steer car sales towards more efficiency. Ukraine policymakers have to consider implementing policies that foster the upgrade of the existing car passenger fleet. Crucially, all policies have to be pursued in a socially acceptable way. Only if effective and affordable alternatives such as a strong public transport system exist, the proposed policies will turn out to be successful.

[6] For gasoline cars, fuel consumption decreased from 11.18 l/100km (2000) to 8.74 l/100km (2015), for diesel cars it increased from 6.98 l/100km (2000) to 7.38 l/100km. Assuming 2,392 grams of $CO_2$/litre of gasoline and 2,640 grams of $CO_2$/litre diesel, we come up with the following average $CO_2$ efficiency of the Ukrainian car fleet: for gasoline cars, efficiency increased from 267 g $CO_2$/km (2000) to 209 g $CO_2$/km (2015), while for diesel cars efficiency decreased from 184 g $CO_2$/km (2000) to 195 g $CO_2$/km (2015).

## Emission standards

Ukraine has relatively strict pollution standards for new vehicles. As of January 2016, only vehicles that comply with the Euro-5 standard are permitted to be registered (Hill & Klimenko, 2016). However, the introduction of the Euro-6 standard, initially planned for 2018, was rescheduled first to 2020 and recently even pushed to 2025 (Ukrainian Journal, 2019). For used cars, Ukraine lowered its standard to Euro-2 in 2018 (Verkhovna Rada of Ukraine, 2019), detrimental to increasing its fleet efficiency. The Euro standard is primarily a pollution standard that limits the emissions of different pollutants but foresees no limit on GHG emissions (European Union, 2007). Ukraine has no own standard that restricts the amount of GHG emissions emitted by newly registered cars.

*Emission stan-dards, especially for used cars, should be discussed to increase passen-ger car efficiency.*

We propose the introduction of a $CO_2$ emission standard for new cars which would make sure that the needed fleet renewable would be sustainable. In addition, Ukraine might be negatively affected by tightened regulatory standards in the EU (Box 1). There is the possible danger that manufacturers will try to sell $CO_2$-inefficient cars in Ukraine instead in the EU. Ukraine should use the opportunity to introduce a legislation similar to EU that would be (1) effective in reducing $CO_2$ emissions from new cars and (2) be simple for manufacturers to comply with, given a possible similarity with EU regulation. In any case, tighter emission standards could effectively lower future $CO_2$ emissions and are possibly politically easier to adopt than other measures.

Background info

# $CO_2$ emission performance standards for passenger cars and light commercial vehicles in the EU

In 2019, the EU saw a mayor update of its $CO_2$ emission performance standards for standards for passenger cars and light commercial vehicles (LCV). Until 2019, Regulation (EC) 443/2009 defined $CO_2$ emission targets for cars, while Regulation (EU) 510/2011 set targets for LCVs. For cars, a target of an average 130 grams of $CO_2$ per kilometre (g $CO_2$/km) was set. Car manufacturers had to ensure that average $CO_2$ emissions of their sold cars in the EU ("EU fleet-wide target") were not above that target in the years 2015 to 2019. This target was tightened to 95 g $CO_2$/km for the year 2021. For LCVs (Regulation (EU) 510/2011), EU fleet-wide targets were at 175 g $CO_2$/km for the period 2017 to 2019 and then decreased to 147 g $CO_2$/km as of 2020.

In 2019, Regulation (EU) 2019/631 was adopted that replaced the preceding regulations. This new regulation aims to reduce $CO_2$ emissions for passenger cars LCVs setting EU fleet-wide $CO_2$ emissions targets for the years 2025 and 2030, applying to newly registered vehicles. Targets are defined as relative changes in comparison to the year 2021. For cars, a 15% reduction target as of 2025 on and 37.5% reduction target as of 2030 is foreseen. For LCVs, the reductions are 15% as of 2025 and 31% as of 2030.

To incentivise the sale of electric and hybrid vehicles, car manufacturers can exceed the benchmark if a certain minimum number of zero- or low-emission vehicles are sold. If targets are not met, car manufacturers have to pay fines according to the number of cars sold in the EU and to the excess of the target.

Since many car manufacturers are supplying the EU car market as well as the Ukrainian car market, Ukraine could indirectly profit from the EU legislation as improved cars will also be sold in Ukraine. However, since the legislation only defines fleet standards, there is a risk that car manufacturers will try to sell inefficient cars to non-EU markets, including Ukraine, to increase fleet efficiencies in the EU.

Source: European Union (2019); EU Commission (n.d.-a, n.d.-c)

### Taxation

*The current taxation system does not properly incentize the uptake of efficent cars. A reform should be discussed.*

A recently published report (Ecoaction, 2020) points out that Ukrainian legislation has moved in recent years towards favouring car ownership. Taxes on vehicle registration and emission of cars were abolished in the beginning of 2015 and the newly introduced tax on car ownership has no real environmental component: while expensive cars are taxed, old and inefficient cars remain untaxed. Although politically sensitive, an effective taxation scheme has to be introduced that favours the uptake of small, efficient cars over inefficient cars.

Ecoaction (2020) points also out that there is a tax privilege for owners of old European cars who do not have to perform customs clearing when importing their car. That policy is detrimental for upgrading the Ukrainian passenger car fleet and for reducing emissions from GHG gases and pollutants.

Stimulating measures have helped to increase sales of electric vehicles. In 2016, custom duties on electric vehicles were abolished, and as of 2018, excise tax and VAT for the import of electric vehicles have been dropped as well (Global Fuel Economy Initiative in Ukraine, 2018). Due to increasing sales of electric vehicles, we believe that further measures (including subsidies) should be viewed with caution as they tend to be very costly and often highly regressive, favouring consumers with higher incomes. Crucially, Ukraine has to decarbonise its electricity sector. Without increasing the share of renewable energy on Ukrainian electricity production, electric cars will not be of help to decrease GHG emissions of passenger cars.

### Used cars

*Measures need to be Introduced that limit the importance of used cars.*

Although politically sensitive, Ukraine needs to tackle the age and efficiency of its passenger car fleet. Its car fleet is old and inefficient, and without upgrading car emissions are unlikely to decrease eventually. Hence, the used car market will have to be limited and the number of foreign registered cars driving in Ukraine to be reduced. Stricter regulations on the registration of cars, the circulation of non-registered cars, higher customs for imported cars, and emission standards for already registered cars could be used to slowly reduce the number of old cars in the Ukrainian vehicle fleet. In July 2020, the Ukrainian government discussed changing the rules of importing cars to limit the number of foreign registered cars driving in Ukraine (Holubeva, 2020). In addition, appropriate and reliable governance structures to (technically) check cars on a regular basis should be introduced. These checks could be used to certify cars regarding their safety as well as emissions.

## II. Urban transportation: cars, local public transport, and active modes

Due to the growing relevance of cities at different socio-economic levels, urban transport policies are increasingly important. However, due to the complexity of urban transportation system, the multitude of stakeholders involved, as well as strong “lock-in” effects, we observe that changes in mobility patterns in cities will be difficult to achieve.

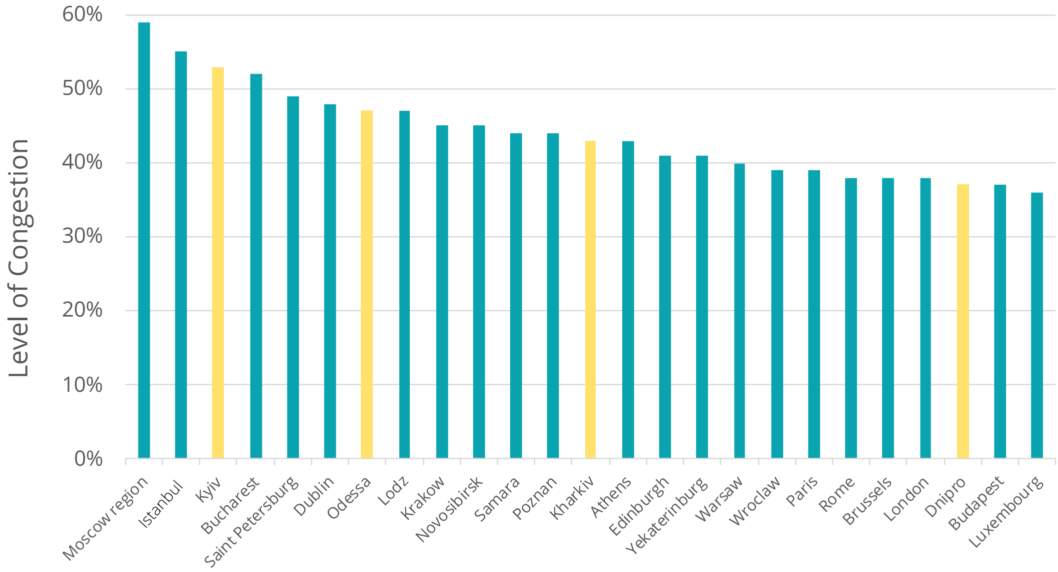
### a. Analysis

*Ukrainian cities are among the strongest congested in Europe.*

Despite the relative low levels of motorisation, recent evidence by the TomTom Traffic index 2019 (TomTom, 2020) and Stepanchuk *et al.* (2017) suggests that Ukrainian cities are strongly congested, actually among the most congested cities in Europe. The index places four Ukrainian cities in the list of the 25 most congested cities in Europe: Kiev ranks 3$^{rd}$ in Europe and 12$^{th}$ worldwide. The increase of congestion has been especially strong in Kiev between 2017 and 2019. The city of Odessa ranks 7$^{th}$ Europe-wide (18$^{th}$

worldwide), Kharkiv 13th (29th), and Dnipro 23rd (47th). Interestingly, Dnipro, a city of around 1 million inhabitants, is just one place behind London, the largest city in the UK (Figure 6).

**Figure 6: Top-25 congested cities in Europe**




*Notes: The TomTom Traffic index (TomTom, 2020) measures the average congestion time of a city. For example, a congestion level of 53% in Kiev means that a 30-minute ride with a car will take 53% longer in congested times than in uncongested times.*

Source: TomTom (2020)

Within Ukrainian cities, cars are however only one mode of transport. A recent study (Rudakevych *et al.*, 2019) provides a comprehensive overview over the state and development of urban (electric) transportation in Ukraine. In competition with local public transport, there are numerous private bus operators (mainly marshrutkas) that drive mostly small buses (Rudakevych *et al.*, 2019). These private companies, a result of the privatisation of the bus system, are mainly operating on highly demanded lines and are not a perfect substitute for public transport, which is supposed to run in less frequented areas as well.

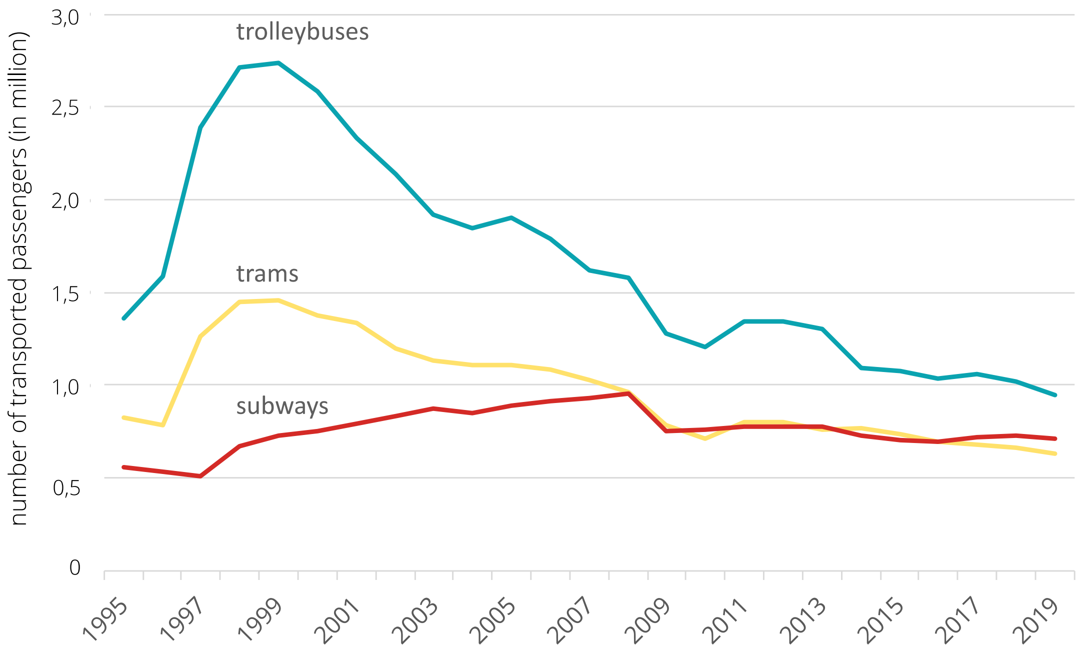
*Ukraine has a strong network of local public transport, which has been witnessing a decline since 1990.*

Overall, Ukraine has still a strong network of local public transport, which, however, has been witnessing a decline since 1990s. At the end of 2018, Ukraine had 19 active tram networks (down from 32 in 1991). Most trolleybus networks remained in operation as their number decreased only slightly from 45 to 41. Three metro networks (Kyiv, Kharkiv, Dnipro) are currently in operation. Yet, the current state of local public transport infrastructure in Ukraine tells us only a partial story about its performance. As Rudakevych *et al.* (2019) reports, the rolling stock (of trams and trolley buses) is renewed too slowly and about 90% of the fleet has already exceeded its foreseen maximum life. In parallel, the number of trams and trolleybuses decreased since the 1990s by 54% and 49%, the number of metro coaches by 50%.

As shown in Figure 7, also the number of passengers of (electrified) public transport decreased strongly in the last 25 years, especially for trolley buses and trams. Only subways were able to gain passengers. While data[7] on car and bus rides are sparse (or not disaggregated), we assume that people have partly switched to cars given that both car ownership and emissions have been rising in the last years.

[7] Available data do not differentiate between local and long-haul buses rides; hence we cannot attribute the number of passengers transported by buses purely to urban bus transportation. Moreover, the number of passengers carried by

**Figure 7: Number of passengers transported by type of carrier**




*Notes: After 2013, excluding Crimea, the city of Sevastopol and the territories in the Donetsk and Luhansk regions.*

Source: Ukrstat (2020b)

## b. Policy Recommendations

*Transport policies have to be thought holistically so that different governance work together.*

As said, cities are gaining importance throughout the world, and urban transportation is becoming more and more relevant. Especially in urban contexts, transport policies have to be thought holistically. That means that it is crucial for policymakers of different levels (e.g. national and local) to work together. Their goals can align when for example federal $CO_2$ reductions targets and local traffic reductions targets can be reached in the same way, e.g. fostering public transport. However, a push of electric cars by the federal levels to decrease $CO_2$ emissions would counteract local ambitions to decrease traffic.

*Alternatives to cars are important and can contribute to an economic development and an increases in citizens' quality of life.*

The promotion of alternatives to cars is important at several levels. Without viable alternatives, citizens have no chance to change their mobility choices, and potential traffic measures will only lead to higher costs. Alternative modes of transportation to cars can also contribute to an economic development and to increases in citizens' quality of life. An improved local public transportation service can enable more citizens to reach areas for work or consumption, which would not be accessible otherwise. Local authorities should also be willing to cooperate with private actors (e.g. via private public partnerships) to reach effective and cheap solutions to reduce traffic and emissions.

To reduce traffic and thus emissions in Ukrainian cities, a combination of "push" and "pull" policies is needed. A potential "push" policy is a congestion charge that is discussed below. Possible "pull" policies encompass the extension of local public transport and the promotion of alternatives modes of transportation.

buses has decreased in the last 25 years. Unfortunately, no data exist that show the development of passengers carried by (private) cars (in urban and/or rural areas).

### Pricing and restriction policies

A possible "push" policy is a congestion charge scheme (Box 2) which could decrease traffic in major Ukrainian cities and generate funds to expand and upgrade public transportation services. Pricing urban traffic via a congestion charge scheme would not only lower GHG emissions, but also decrease local pollution, noise, commuting times, and the need for infrastructure repair. Another policy of that kind would for example be the introduction and increase of effective parking fees in public spaces.

*Pricing urban traffic could be one tool to lower GHG emissions.*

Car restriction policies (for example on the basis of the number (even/odd) on the license plate) are seemingly effective at first sight but can often lead to unintended consequences in the long run, as citizens tend to adapt their behavior. Car ownership increases because citizens buy a second car which is often old and inefficient. Thus, emissions and pollution can even increase because of wrongly designed car restriction policies (Berg *et al.*, 2017).

### Public transport

As Ukraine has already an existing and far-spread system of local public transport, we see most potential to reduce traffic and emissions by extending and improving its quality. We believe that the trend of shrinking passenger numbers has to be reversed. Obviously, an extension of service will come along with substantial costs that have to be borne by local authorities. Every municipality has to find its own solution as no "common solution" unfortunately exists. Yet, it is important that local and federal governments work together to reach the common goal of traffic and emissions reductions, as well as a better transport service for inhabitants.

*Local and federal governments need to work together to extend and improve the quality of public transport.*

Tram lines as well as (electric trolley) buses with separate lanes are a rather cheap and effective way for local governments to extend its service. There are many promising projects (such as Bus Rapid Transit) that could be applied in Ukraine would not be as costly as other local public transport means (IFT, 2019). Metro lines should only be considered for very congested areas and only if no other practical solution is available. Due to the long planning and construction time, metro services cannot decrease traffic and emissions in the short term and their high investment costs are a major obstacle for local governments.

Background info

## A congestion charge for Ukraine?

Given the high share of road emissions and the level of congestion in Ukrainian cities, could a congestion charge system by a sensible policy in Ukraine? A possible system could include all mayor Ukrainian cities with more than 500,000 inhabitants (Kiev, Kharkiv, Odessa, Dnipro, Donetsk, Zaporizhia, Lviv, Kryvyj, Rih). Together, these 8 cities have 9.4 million inhabitants corresponding to almost a quarter of Ukraine's population (Ukrstat, 2020c).

Distinct models of congestion charging exist: (1) the London model charges a daily fare independent of the time of entry in the zone (certain times excluded) (Transport for London, 2020), while (2) the Stockholm model has varying fares during the day (Transportstyrelsen, 2020). It is important to think about which types of vehicles (low emission, residents, buses etc.) can enter for free or are eligible for reduced fares as this affects strongly results and revenues of the scheme. A congestion charge that excludes certain low emission vehicles (e.g. hybrid and electric vehicles) could help to renew the Ukrainian car fleet and thus increase overall energy efficiency (Beck *et al.*, 2011; Morton *et al.*, 2017). That could be effective in combination with stricter $CO_2$ emission standards for new cars. In order to build a socially just system, fees could be coupled to income or other indicators.

Most existing empirical studies show a long-run reduction in traffic, yet reductions vary a lot depending on city, design, prices, and exemptions (Anas & Lindsey, 2011; Eliasson, 2009; Lehe, 2019; Transport for London, 2007). Overall, reductions in traffic (mostly measured in entries to the priced zone) are between 10% and 40%, the associated $CO_2$ reductions are between 14% and 19%. To make congestion charging effective and avoid a simple tax increase, alternatives modes of transportation that citizens can use have to be available.

Implementation costs vary strongly between different cities (Anas & Lindsey, 2011) and are therefore hard to predict. However, experience has shown that these schemes are usually quite profitable for cities. Thus, we expect that participating cities would recover first investments within a few years. Therefore, effective congestion charging could contribute to the reduction of traffic and at the same time raise necessary funds for the extension and improvement of local public transport.

### Carsharing/-pooling and priority lanes

Carsharing and -pooling is another efficient way of reducing the number of cars in cities and thereby reducing traffic and emissions. Thanks to digital solutions, local authorities could relatively easily create databases that connect drivers with potential co-passengers, so that existing car rides are used more efficiently. Priority car lanes which can only be used by vehicles with 2 or more passengers can support carpooling and are a quick and not a costly way for local authorities to steer transport.

### Active modes of transportation

*Active modes of transportation can be a cheap way to reduce traffic and emissions.*

Alongside cars and public transport, local governments should promote active modes of transportation, such as cycling and walking. Citizens will only decide to walk or to take the bike if safety is guaranteed. Hence, local governments have to enable a safe infrastructure first. In contrast to most public transport measures, the promotion of active modes of transportation is cheap and an important complement for urban transportation.

## III. Freight: Trucks and railway

### a. Analysis

*Rail is dominating domestic freight transportion.*

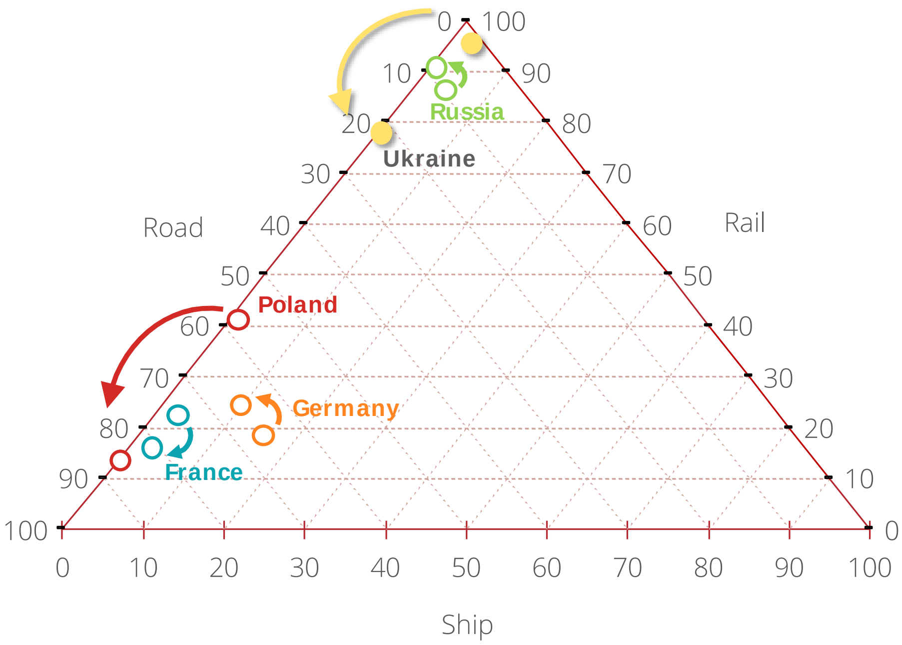
Like other economic sectors, inland freight transport[8] has seen a steep fall after 1990 and then stabilised in the late 1990s. Since then, it has kept constant with a slight upward trend. Since 1990, the dominance of rail in inland freight transport has not changed fundamentally. Yet its share has fallen over the years from 95% in 1990 to around 78% in 2019. Especially transportation on roads has gained importance and is now at 21% while water remains at 1% (OECD, 2020). In terms of transported tonne-kilometres, Ukraine's rail

[8] In the entire subsequent analysis, we have excluded inland freight transport by pipelines because of the distinctively different nature. All freight figures shown below do not contain any pipeline transport.

system dominates domestic freight transportation. Heavy products such as steel, coal, as well as grain, are the backbone of the Ukrainian economy, and rail handles their transportation. However, this might change in the future if the Ukrainian economy moves away from heavy industry towards a more services-based industry model.

As said, the dominance of rail for freight has not been changing much in recent years. Comparing to other countries (Figure 8), we see that Ukraine has a very high share of railway yet is slowly moving towards the “Western” model (Germany and France in the figure) of freight transportation with higher road shares and lower railway shares. A similar, but stronger trend has been visible in Poland that has even “overshot” and has now even a higher share of road transport than France and Germany.

**Figure 8: Change in share of freight transport type (in tonne-km), 2000-2018**




Source: OECD (2020)

Regarding trucks, Ukraine has seen a shift of commercial transport emissions from heavy-duty commercial vehicles (HCV) to a more even spread between these and light-duty commercial vehicles (LCV). The share of HCVs on all road emissions has been 68% in 1990 and decreased to 29% in 2014, while the share of LCVs increased from 2% (1990) to 9% (2014).[9] Similar to cars, the age of Ukraine’s truck fleet is high, and an upgrade is urgently needed.

[9] Given the remaining importance of emissions from HCV, one major obstacle in the analytical process is data availability and quality. Data on fleet composition, registration, efficiency, and related topics is extremely spare for Ukraine.

## b. Policy Recommendations

### Trucks

*To decrease emission, $CO_2$ emission for trucks should be introduced.*

Ukrainian legislation requires also older trucks to follow more recent European emission standards (Euro 5). However, there are doubts about the accuracy on recent upgrade numbers (Kyiv Post, 2018). Similar to cars, Ukraine does not have any regulation on $CO_2$ emissions for trucks. Thus, we believe that it should discuss the introduction of a $CO_2$ emission target for trucks like the legislation introduced in the EU (Box 3). Certain best practises could be adopted from the EU and manufacturers would have to follow a similar set of regulations. Like in the case of cars, stricter $CO_2$ emission standards would limit the risk that Ukraine becomes a place where $CO_2$-inefficient trucks would be sold to as they cannot be sold in the EU.

*A gradual fade-out of used trucks could increase fleet efficiency.*

Although a recent increase in sales of more modern trucks has been seen, the Ukrainian truck fleet is still dominated by many old and inefficient vehicles (Kyiv Post, 2018). Ukraine should consider to gradually fade out old $CO_2$-inefficient trucks from its truck fleet. This step would require a scheme to regularly check trucks and their conformity with efficiency standards. Policy makers will have to discuss whether old, inefficient trucks should be allowed to continue operating in Ukraine.

The truck sector in Ukraine is shaped by small companies and individual drivers. Forcing out old vehicles through stricter legislation and preventing the registration of inefficient ones through tighter emission standards could have a strong impact on their business as they might not be able to afford to upgrade their rolling stock. However, the Ukrainian government could accelerate the turnover of the truck fleet by a corresponding support scheme for small enterprises.

Background info

### EU's $CO_2$ emission standards for heavy-duty commercial vehicles

Regulation (EU) 2019/1242 is the first EU-wide legislation that sets $CO_2$ emission standards for HCVs and came into force in 2019. It requires that newly registered heavy-duty commercial vehicles (HCV) emit on average 15% less $CO_2$ by 2025, and 30% less by 2030 compared to the reference period 2019-2020. Like Regulation (EU) 2019/631 (which applies to cars and vans), truck manufacturers must decrease emissions based on their EU fleet-wide average. The regulation incentivises truck manufacturers to sell zero- or low-emission vehicles as these allow manufacturers to exceed the efficiency limit. A similar legislation in Ukraine could help to modernise the HCV fleet, increase $CO_2$ efficiency, and foster uptake of modern (electric) trucks.

Source: European Union (2019a); EU Commission (n.d.-b)

### Railway

As only 47% of Ukraine's rail tracks are electrified (Ukraine, 2018b), an increased electrification and an expansion of renewable energy production could even further decrease emissions. Although, we have no explicit data on rail track usage and in most countries electrified tracks see a higher numbers of trips per days. Thus, the share of percentage of electrified tracks is a too conservative measure for the degree of electrification of the Ukrainian railway. Due to the already low emissions, emission saving within the rail systems should not be the main policy focus. Instead, the rail system has to be upgraded in a way that it can enable emission reduction by replacing other forms of transportations. Regarding modern forms of efficient freight transport, Ukraine has to make sure that its train service can be competitive against truck services and can be integrated in multi-modal freight transport chains. Overall, future infrastructure spending should primarily be directed to the rail system. Investments are needed to improve the efficiency and to make rail competitive enough to attract a substantial share of freight.

*Infrastructure spending should primarily be directed to railway to make it competitive enough to attract more freight in the future.*

## IV. Long-haul passenger transport: railway and aviation

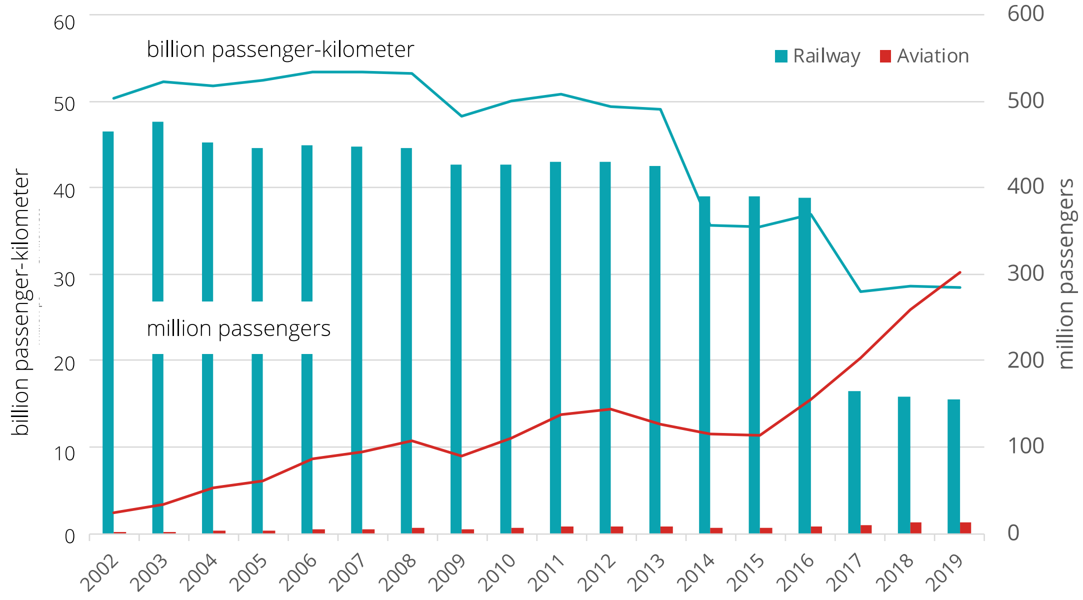
### a. Analysis

Our analysis of rural and long-haul passenger transport is comparatively short. As data are limited (footnote 7), we restrict our analysis to rail and domestic aviation passenger transport. As shown in Figure 9, unsurprisingly, passengers carried by railway are significantly more than passengers of air planes (bars referring to right axis). Despite changes in methodology in 2017, we see however a long-term trend of reduction of passengers of railway and a long-term term trend of passenger increase in aviation (yet on a low level, see small green bars). Passengers by rail dropped from 465 million in 2002 to 155 million in 2019. In the same time, aviation increased its passengers from 2 million to 14 million.

*In recent years, the number of passengers transported by rail decreased, while domestic aviation gained passengers.*

When analyzing long-haul passenger transport in terms of passenger-kilometers (lines, left axis), we see how domestic aviation has caught up and even overtook passenger transport by rail in 2019. Between 2002 and 2019, aviation increased its passenger-kilometers from 2,400 to 30,200, while railway decreased from 50,400 to 28,400. The discrepancy seems to suggest that passenger transport by aviation becomes increasingly important for domestic long-distance travel, which explains the rather low passenger numbers but high passenger-kilometer numbers.

**Figure 9: Passengers of railway and domestic aviation (lines - left axis, bars - right axis)**

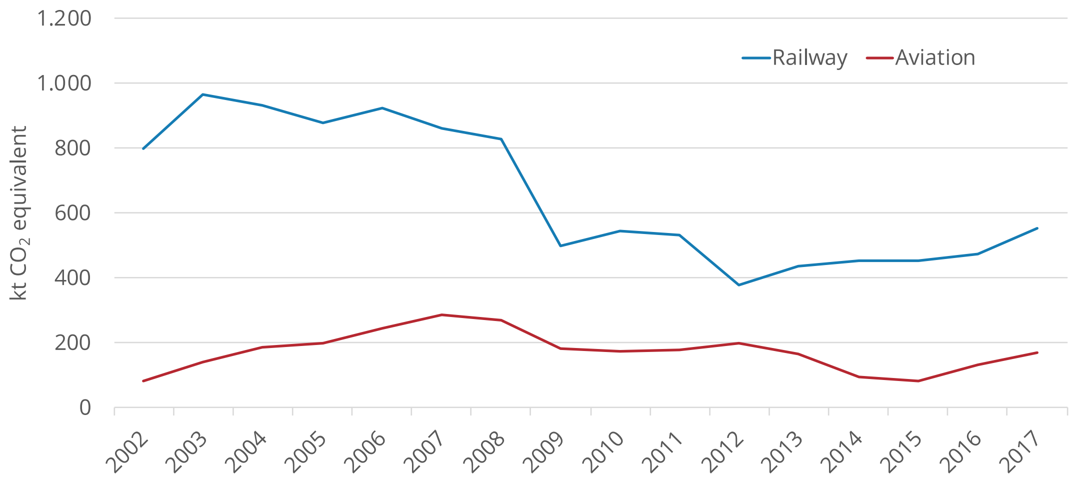



*Notes: For railway, the number of* *<u>passNengers</u>* *carried according to data from the joint-stock partnership "Ukrzaliznytsia"; since 2017, including passengers transported by city rail; since 2017, the procedure for accounting passengers carried by rail who enjoy the benefits of free travel has been changed; since 2010, data excluding the territories of Crimea, the city of Sevastopol and parts of the eastern part of the country.*

Source: Ukrstat (2020b)

Emissions from domestic aviation decreased strongly in the 1990s and then increased again in the 2000s. The recent crisis of 2014 lowered emissions again but since then we see a steady increase in domestic aviation emissions (Figure 10). Overall, domestic aviation contributes only marginally to Ukraine's transport GHG emissions. The same holds true for railway which saw declining emissions since the 1990s and only most recently an uptake.

**Figure 10: GHG emissions from railway and domestic aviation**




Source: UNFCCC (2020)

## b. Policy Recommendations

The railway system needs to be set up as potent competitor against domestic flying and inter-city car passenger rides. As international evidence suggests that there is a competition between freight and passenger transport within rail and proper coordination among these two segments is not easy to achieve, a good railway management and coordinated policies are needed.

*When it comes to future investment spending, rail should be favoured over domestic aviation to decrease emissions.*

Ukraine's transport strategy for 2030 (Ukraine, 2018a, 2018b) plans the upgrade of domestic airports and the increased integration of Ukraine in international air connections. While these goals and measures can have positive regional effects, domestic aviation should be viewed with scepticism. As argued before, an increased effort to upgrade the Ukrainian rail system should be undertaken. As already seen in many countries, an efficient high-speed train system could compete with domestic flights and take over its function. However, efficient, and high-speed train systems require substantial investments, especially in countries that do not yet have such infrastructure.

## Conclusion

While most countries worldwide have seen increasing GHG emissions, especially in the transport sector, Ukraine experienced strong emission reductions in the 1990s. Thus, we believe Ukraine is in a good position to comply with future international climate targets.

*The future mobility sector should focus on the needs and possibilities of the 21st century and not replicate the dead-end mobility strategies of many EU countries.*

Policymakers in Ukraine should use this situation to steer the transport sector in the right direction, in order to make future emission reductions attainable. Therefore, Ukraine should focus its future mobility sector on the needs and possibilities of the 21st century and should not replicate the dead-end mobility strategies of many EU countries. Instead of solely focusing on individual mobility provided by car transportation, these should just be seen as an additional option and only be used when other forms of transportation are difficult to be provided. While many countries face the challenge to reduce emissions from cars, Ukraine could more easily reach a low-carbon transport future because it has still a relatively low level of motorisation. Instead of increasing that level by all means, viable alternatives could lead citizens directly to use public transport or long-distance trains, instead of increasingly switching to cars.

*In cities, fewer cars would go hand in hand with less pollution, less congestion, less noise and an improved quality of life and health.*

The goal of fewer cars, especially in cities, would also go hand in hand with several co-benefits, such as less local pollution, less congestion, less noise and an improved quality of life and health in cities. A limited number of cars and an increased efficiency of the remaining car and truck fleet would also decrease dependence on oil imports. As the coming decades could witness changes in Ukraine's industry, rail could increasingly shift to passenger transport instead of freight, due to a shrinking demand for heavy duty transport and to an increase use of maritime transport.

Ukraine has published two policy documents that aim to guide the transport sector towards a low-carbon future: the "Ukraine 2050 Low Emission Development Strategy" (Ukraine, 2017) and the "Transport Strategy 2030" (Ukraine, 2018b). While the Low Emissions Strategy discusses broad goals, the Transport Strategy lists numerous details measures. However, it remains unclear how these measures fit in a broader cross-sectoral strategy. There is no value in tackling issues individually as the different measures are highly interdependent. Therefore, Ukraine should consider integrating individual transport policy measures into a comprehensive strategic framework that comprises all sectors of the economy.

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We are grateful for your feedback on this Policy Proposal. Please get in touch via info@LowCarbonUkraine.com.

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