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# POSSIBILITIES TO ENSURE SUSTAINABILITY AND A GREEN STRATEGY IN HUNGARIAN ROAD TRANSPORT

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***Abstract:*** *Greening transport plays a key role in fulfilling climate goals and carbon neutrality. The sector is responsible for one fifth of greenhouse gas emissions in Hungary. Electric transport creates the possibility of zero emissions, so the Green Strategy can be implemented by supporting the spread of electric cars and implementing the Green Bus program. Our goal is to realize climate strategy, green transport, sustainability by taking into account the financial possibilities. Financial support is needed to put transport on less polluting fundaments. It can involve introducing a new type of tax or supplementing existing taxes. Based on the polluter pays principle, this can be mileage or consumption based. At the same time, the increase in fuel costs for heavy duty vehicles reduces competitiveness, so compensation is needed for the sustainable operation of hauliers and delivery companies.*

***Keywords****: Ensure Sustainability, Green Strategy, Hungarian, Road Transport*

## INTRODUCTION

The main objective of Green Strategy is to create the conditions for a sustainable growth model, which will enable Hungary to become a climate-neutral country by 2050 without the burden of transition being mainly being caused by top polluting countries. We must work together with the world's biggest polluters to tackle the cross-sectorial effects of climate change, and our long-term task is to reduce greenhouse gas and pollutant emissions while maintaining the competitiveness of the economy. Accomplishing this goal requires all emitter sectors to adapt to changing circumstances. Climate protection goals can only be reached together. 98% of transport's greenhouse gas emissions come from the road sub-sector; hence this field already requires well defined measures for today.
Electromobility and other alternative technologies are expected to become more prominent in the next decade, which could underpin the decarbonisation of road transport in the long run. Greening urban transport will play a significant role in the Green Strategy. The decarbonisation process requires the involvement of all stakeholders, from automobile industry to industrial pollutants. [1, 2] Transport contributes to air pollution in several ways. Vehicles emit harmful substances that endanger health (organic compounds, CO, $NO_2$, $SO_2$ and the PM and ozone formed from them), as well as greenhouse gases ($CO_2$) being not harmful, but causing climate change. Vehicle emissions cause direct health problems in areas with heavy traffic and spread from there to areas not affected by industry and transport, while increasing concentrations of greenhouse gases are leading to global warming.

The multi-directional pollution effect can be mitigated globally by reducing road transport emissions. Achieving net zero emissions is most important for Hungary, situated in the Carpathian Basin because atmospheric pollutants are difficult to clean from the atmosphere. . Rainy-windy weather would be needed for natural purification, however, climate change, on the other hand, is bringing a decrease in the amount of precipitation to Hungary. These factors lead to the need for Hungary keeping water within the country and attaining the lowest possible pollutant concentration are the two main goals.

## CLIMATE STRATEGY AND ENVIRONMENTAL PROTECTION

The biggest challenge for transport in the 21st century is to meet the increased demand for mobility while minimizing its damage to the environment. Among the environmental impacts of transport, we can find harmfulness for health, the effects on climate change, traffic noise, accidents and the consequences of traffic jams. A large-scale increase in transport demand and the alignment of the climate strategy are possible with measures in

- meeting the requirements of sustainable development,
- using technical developments,
- increasing the share of environment-friendly transport sub-sectors and
- by advantageous combination of different modes of transport and
- by carrying out planned and conscious environmental management activities.

Green, environmental-friendly, sustainable operation can also increase efficiency with lower specific energy consumption or less material consumption.

## SUSTAINABILITY

The Brundtland Commission has developed the most widely used concept of sustainable development: “Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (Brundtland World Commission on Environment and Development, 1987). The direction of decisions has shifted over time from the primary emphasis on environmental issues to a common focus on environmental responsibility, social awareness and economic profitability in development.

Based on the above factors, a transport project can be considered "sustainable" if:

(1) contributes to economic development,
(2) meets the transport needs of society,
(3) is in accordance with natural laws and human values.

In addition, it is necessary to take into account:

(4) the degree of sustainability is sensitive to the economic, social and environmental conditions of the project site,
(5) the appropriate definition of "sustainable transport projects" for the "long-term approach" should cover the whole life cycle, from concept to operation, maintenance and the recycling / reuse phase.

Sustainability is worth considering at the planning stage, as at the evaluation and decision-making point of projects:

- decision-makers have a major influence on the future sustainability and environmental performance of the project,
- implementation of the principles of sustainability and climate strategy becomes more effective at the planning stage than as part of the ex-post evaluation,
- integration of sustainability objectives into the decision-making process can support the most cost-effective outcome for all criteria considered,
- after identifying project impacts, the multi-criteria approach can be used, for example, to weight the strength of impacts,
- ranking of alternatives helps to select the most sustainable project proposal.

## IMPACT OF ROAD TRANSPORT POLLUTANTS

Road transport is partly responsible for urban air pollution, which endangers the health of many people. Higher concentrations of harmful substances increase the risk of cardiovascular and respiratory diseases, cancer and adverse birth events (low birth weight, preterm birth) and also result higher mortality rates with reducing the number of healthy life years. Pollutants emitted by vehicles, according to WHO (World Health Organization) estimates, claimed the early deaths of 4.2 million people worldwide in 2016.

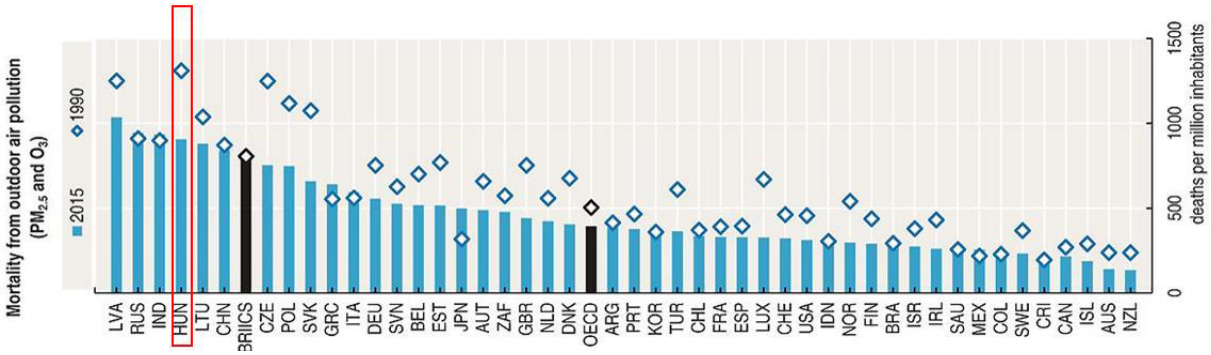



Figure (1): Deaths due to air pollution per 1 million people in OECD countries, plus China and India in 1990 and 2015 [3]

The harmful effects of air pollution on health in the Carpathian Basin are exacerbated; therefore it is necessary to reduce emissions as much as possible, involving all sources, including road transport. Due to the topography of Hungary, the purification of air pollutants is inhibited and photochemical reaction takes place to result the formation of $PM_{2.5}$ and ground-level ozone ($O_3$). Their starting materials are NOx and $SO_2$. Emission can be cut down directly by efforts to decrease the concentration of harmful substances, but it can also be aimed by supporting the purchase of vehicles with battery- or hydrogen-based electric propulsion.

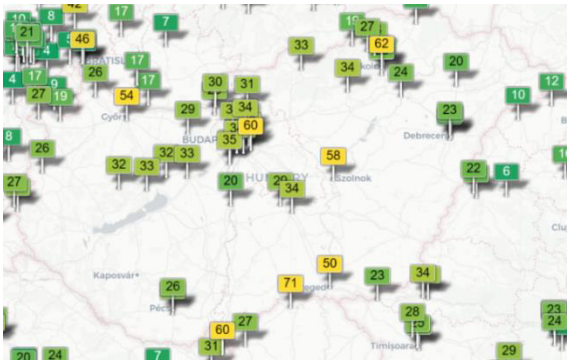


Figure (2): Air pollution in Hungary: A visual map of the real-time air quality index (13/03/2020) [4]

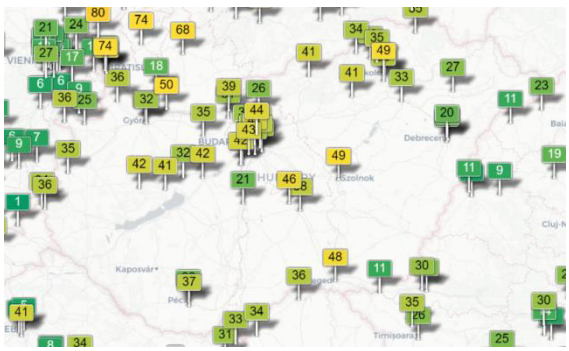


Figure (3): Air pollution in Hungary: A visual map of the real-time air quality index (30/04/2020) [5]

Figures show that the air quality index has fallen from 60 to a low-risk value below 50 (adequate level) in Budapest during the one and a half months of traffic stoppages, but has risen from 30 to 40 in rural areas. There was neither a sufficient amount of rain nor windy weather during this period of time. Concentrations of $NO_2$ from transport emissions were decreased by 19% during lockdown, but concentrations of $PM_{10}$ increased by 3% over the same period. The source of $PM_{10}$ is mainly residential heating; a small amount comes from transport only.

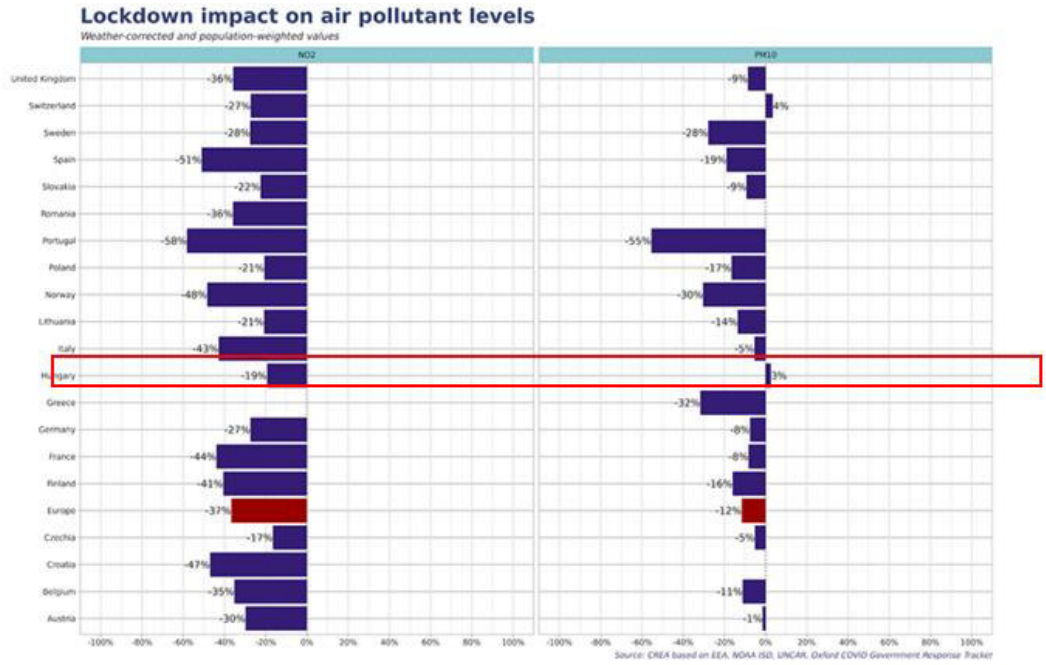



Figure (4): Changes in $NO_2$ and $PM_{10}$ level in European countries compared to the same period of the previous year [3]

A decrease in the concentration of small particulate matter in the atmosphere is accompanied by a decrease in the amount of precipitation (raindrops would condense on the surface of the dust). In March and April 2020, less precipitation fell than the average of previous years.

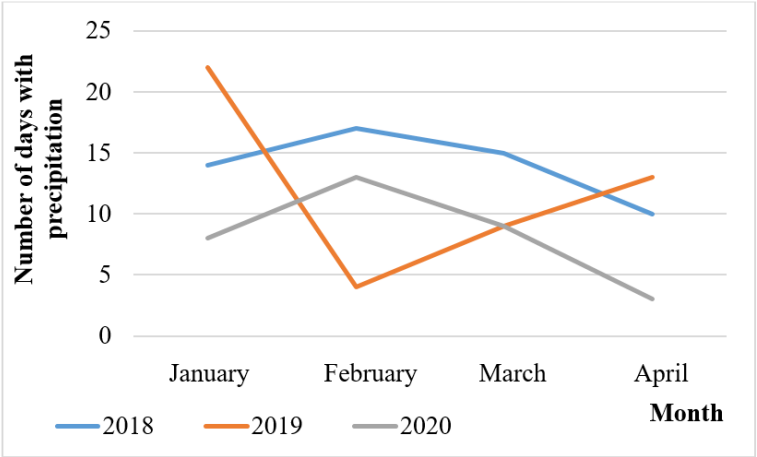



Figure (5): Changes in the number of rainy days in the period January-April, 2018-2020. years

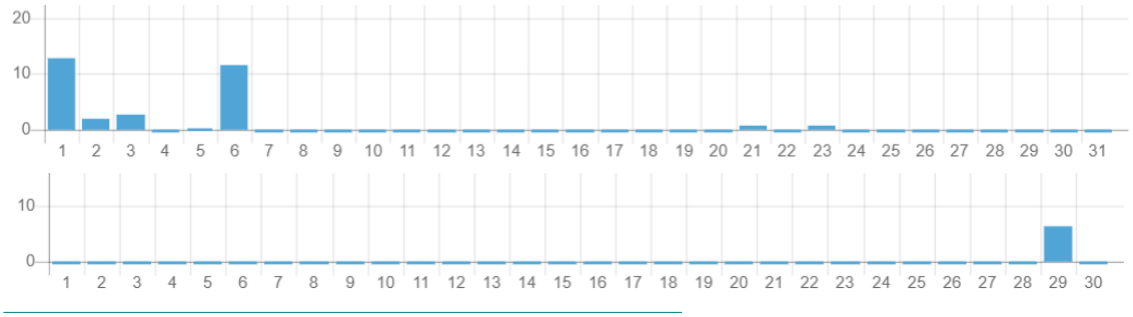



Figure (6): Precipitation, March and April 2020 (mm)

An increase in the concentration of carbon dioxide in the troposphere has no detrimental effect on human health, but as a greenhouse gas it contributes to the increase of the temperature of atmosphere and water and the acidification of the oceans. The melting of ice shelves and rise of more frequent forest fires, stronger hurricanes, and more variable and unpredictable weather can all be attributed to climate change. In Hungary the rise in temperature shifts the conditions in a more volatile and drier direction. The lockdown in transport has also led to a reduction in $CO_2$ emissions, but this will only be reflected in a small reduction in atmospheric $CO_2$ concentrations in the future.

## PROJECT PROPOSALS FOR TRANSPORT GREENERING

KTI Institute for Transport Sciences Non Profit Ltd has compiled a list of project proposals for the possibilities of greening transport. Selected project proposals that offer different solutions to the problems that arise in road transport, so that, as from a menu, they can be selected and adopted for the given situation, as follows:

1. Performing the greatest reduction is possible by placing mobility on an electrical basis, especially if the electricity required for this is at the same time of green origin, so both go hand in hand with the goals of climate neutrality.

Examples of such solutions are of electric public transport vehicles. Here, mainly trolleybuses and electric buses can be considered as developed technology. High-capacity articulated trolleybuses are now able to move on a few km with their battery, without an overhead line. In addition to public transport, electric propulsion may also be required for service vehicles, taxis and luggage carriers, which circulate in cities. At the same time, the purchase of electric cars can be selectively supported, with the help of a tax rebate, credit, and even the regulation on the electrification of vehicles leased or used by companies.

For the post-epidemic period, the Hungarian government has developed a fundamentally new program to support electric cars. The budget of the tender was HUF 3 billion and started on June 15, 2020, and has been repeated in 2021 as well. An additional HUF 2 billion could be requested for taxis. For new passenger cars with a list price of less than HUF 11 million, all-electric cars receive HUF 2.5 million in state gratuity, while in the price category between HUF 11 million and HUF 15 million there is a state subsidy of HUF 0.5 million.

2. In addition to electric propulsion, the fuel cell solution is also environmentally friendly and contributes to greening. Hydrogen-powered technology is already available for buses and cars, but in very small amount. If the supply of hydrogen-powered vehicles, the availability of filling stations and domestic energy targets also point in this direction, the purchase of these vehicles also will need to be supported.
3. The third group of emission reductions includes support for community travel. The options are: making urban public transport more attractive, developing agglomeration public transport and expanding P+R systems. High passenger capacity has lower specific emissions, reducing both the load on road traffic and the likelihood of congestion. If public transport is placed on an electric fundament, greening is even greater. Transport-sharing is also possible at the car level; the necessary applications are already available.

4. The fourth group of options aims at reducing the concentration of pollutants in the exhaust gases. Restricting the use and import of vehicles with out-of-date technology, tightening the conditions for periodic roadworthiness tests, stepping up roadside inspections or filtering out extremely polluting vehicles will help to eliminate pollution sources. Old-style buses, used only for sightseeing, would also require stricter regulations. In Hungary, the average age of vehicles is high and not all owners can pay the maintenance costs. Another option is attitude formation. By mastering the eco-driving technique, fuel consumption can be minimized, while monitoring the condition of the vehicle allows for early detection and management of problems.
5. The fifth project group includes the possibilities of traffic management and traffic reduction. Here we can mention the introduction of recovery restrictions, either selectively or completely. The creation of low-emission zones, the expansion of no-drive areas and the restriction of public parking are also among the possible options.

At the same time, it is not only urban transport that can be greened by organization. With the involvement of the other sub-sectors, freight transport can be diverted to rail, with roads only need to be loaded from the house to the transhipment nodes.

6. The sixth group of proposals is to divert road users to use bicycles, scooters or other zero-emission solutions. This requires the expansion and improving the safety of urban cycle paths, of which we have seen many good examples recently. Increased urban cycling traffic during the epidemic period also showed that cycling would have a raison d'être if their safe transportation was resolved.

## ECONOMIC CONSIDERATIONS

Public revenues from road transport are intended for the development, maintenance and operation of the road network, including the reduction of externalities caused by road users. At the same time, there is hardly any environmental and additional expenditure in the budget that is specifically designed to reduce the externalities of transport. Existing expenditures, on the other hand, always require compliance with increasingly stringent environmental regulations, such as the design of a new road, which requires very strict environmental conditions, which obviously have significant additional costs when it enters the implementation phase and is included in transport expenditure. However, there are only a few specifically environmental interventions on existing road infrastructure (e.g. some noise walls). Expenditures on road network lags behind revenues specifically collected from road users, but if expenditure on public and rail transport is interpreted solely as a reduction in the external effects of road transport, expenditures already far exceeds revenues. Revenues from fuel for transport greening and environmental protection can be obtained in the following ways:

- introduction of a new type of tax
- raising excise duty
- raising other taxes or fees

*Environmental tax*

An environmental tax on fuel is justified in some form, as the combustion of fuel produces greenhouse gases and several local pollutants (e.g. particulate matter PM10, NOx) that pollute the environment, deteriorating the health of those living in the environment and thus compensating for externalities, which should be compensated by the state. The most appropriate form of taxation to offset the pollution of road transport is a tax on fuel, as the harmful effect is proportionate to its consumption. A new tax could be paid by producers (or importers) or rather the distributors and they would account it further to the final users (as it works in case of excise tax or VAT).

*Excise tax*

It is more appropriate to limit the scope to distributors, because the collection of taxes is also simpler and producers are usually foreign, they could not be taxed directly. Distributors, on the other hand, are also subject to excise duty and VAT, as they also collect these taxes built into the price of fuel. In Hungary, the rate of excise duty has never been at the forefront of Europe. The largest Central European carriers, such as Poland, Lithuania, Romania, Bulgaria, also have the lowest rates of excise

duty. As of January 1, 2011, Hungary has also introduced the institution of excise tax refund for commercial gas oil, which is already in practice in some other EU member states (Belgium, France, Italy, Slovenia), with which the net excise tax level came closer to the EU minimum. For the purposes of the Directive, the minimum tax value includes all taxes other than excise duties on energy products other than VAT (Article 4 (2)). In Hungary, such a tax is the stockpiling fee, which in the case of diesel has been 3.883 HUF per litre since June 2020, but also includes carbon taxes and other environmental taxes. It would be useful if there would be a 3-4 HUF per litre earmarked environmental tax as part of the (increased) excise tax. The institution of commercial diesel rebates is an important opportunity to remain competitive, as smaller Central European countries could suffer large revenue losses if, in addition to private fuel tourism, carriers optimize their refuelling in the lower tax burden country (in addition it is much easier for them and they decide on larger volumes). Thus, in these countries it is also an economic compulsion to keep the excise tax at a minimum level, which can be achieved with a discount on commercial diesel even in the case of a higher normal excise tax rates. In Hungary, the amount of the commercial diesel price used to be set just above to the EU minimum tax level (0.33 EUR per litre) [7]. Our proposal is to keep this policy but it is also recommended to increase normal tariff of the excise tax of gasoline by 15%, while excise tax of petrol should be increased much less. At the same time discount for commercial diesel should be increased with the same price difference in HUF in order not to maintain current excise tax tariff. There is a moving part (10 HUF per litre for gasoline and 5 HUF for petrol) of the tax if the oil price is under 50 USD per barrel and it is set every quarter of a year. This moving part of the tax should rather be introduced already under 60 USD per barrel price, while the value of it and the update period should be more sophisticated (e.g. 0.8 HUF/USD oil price difference under the limit and every month).
In 2019, according to the Hungarian Tax Authority (NAV)'s fuel turnover statistics, the turnover of petrol and 4.5 billion litres of diesel were nearly 2 billion litres, so a tariff increase of HUF 1-1 per litre would increase the budget's excise tax revenues by HUF 5.6 billion (plus approximately HUF 1 billion VAT).
The purpose of the excise tax is currently according to the regulations:

- providing revenues necessary for the performance of public finance tasks,
- operation of a competition-neutral tax system,
- Hungary's participation in the European Union as a Member State, with special regard to the resulting legal harmonization obligations in the field of excise duties.

Thus, neither the financing of transport infrastructure nor environmental reasons can be found among the objectives of the excise tax, although it is obvious that since this indirectly results in additional expenditures of the state in proportion to increased fuel consumption (~ increase in road traffic), it seeks a targeted and proportionate source. The toll proportional to mileage currently only applies to lorries, their use of motorways and trunk roads, where the toll is not levied on all vehicles and kilometres driven. At the same time, we can say that there is a distinction according to the environmental category in the case of truck tolls. From the introduction on 1 July 2013 until 2018, EURO-III lorries have already been able to receive the best environmental rating in terms of tolls, and since 2019 only lorries with at least EURO-V environmental rating have been awarded. In all cases, at least 90% of the mileage was in the best environmental category, i.e. no significant additional revenue was associated with it, but hopefully indirectly facilitated the transition to a less environmentally damaging technology for trucks.
A tax adjustment of HUF 1 per litre for petrol and HUF 2 per litre for diesel, which better reflects the relative proportions of environmental pollution and would be more in line with each other, would mean additional annual revenue of HUF 9.4 billion (plus approx. HUF 1.5 billion HUF VAT) in addition to fuel turnover in 2019. The double revenue compared to the previous version seems to be sustainable even in the case of the 2 HUF per litre petrol and 4 HUF per litre diesel increase. Excise duty is also, in fact, a special tax levied on energy products, such as fuels, which are presumed to incur some additional health and environmental costs for the state due to their use. The objectives of the excise tax do not include the financing of transport infrastructure or environmental reasons, although it is clear that since these indirectly result additional expenditures, so the government must seek a targeted and proportionate source in proportion to the increased fuel consumption (i.e. traffic too).

***Vehicle tax of trucks***

The toll proportional to the mileage currently only applies to lorries, their use of motorways and trunk roads, i.e. the toll does not apply to all vehicles and kilometres driven. At the same time, we can say that there is a distinction according to the environmental category in the case of truck tolls. Act LXXXII of 1991 on vehicle tax rules vehicle taxation and company car tax as well. The tax was collected by the municipalities, they could keep 40% of the amounts collected, and the rest had to be transferred to the central budget. From the introduction on 1 July 2013 until 2018, EURO-III lorries have already been able to receive the best environmental rating in terms of tolls, and since 2019 only lorries with at least EURO-V environmental rating have been awarded. Since 2020, the vehicle tax is 100% central revenue. The lower limit of the toll reduction can be raised to EuroVI types. Overall, the best tax base for carbon taxation is to determine fuel consumption, the local pollutant capacity, which also depends on the technology used, but the type of fuel alone is less suitable. In the case of lorries, the tax base is the unladen weight of the lorry in the official register, increased by 50% of its payload, in the case of a tractor it is twice the unladen weight of the lorry, increasing the semi-trailer) with half the positive difference between the maximum permissible laden mass and the unladen mass of the tractor.

The rate of motor vehicle tax is HUF 850 for every 100 kilograms of the tax base started in the case of a truck, tractor, and bus with an air spring or equivalent suspension system, otherwise it is HUF 1,380. There is a 20% tax reduction for EURO-III rated lorries (30% for semi-trailer tractors) and a 30% tax reduction for EURO-IV or better lorries (50% for semi-trailer tractors). The EU-wide minimum level of motor vehicle tax is set out in Directive 1999/62/EC (Eurovignette)[6], broken down by number and distribution of axles and permissible gross vehicle weight. Items have remained unchanged since the entry into force of the Directive in 1999, and even in the previous Directive 93/89/EEC the itemized amounts remain unchanged (from 1 January 1995), then in ECU (the predecessor of the euro). The methodology for setting the European minimum tax level is deficient in several respects. It's only known description appeared in the Official Journal of the EU on 20.03.1991, when its proposal, submitted in 1987, was amended by the Commission. According to this, the method of calculating the minimum car tax rate is

$$\text{minimum vehicle tax} = 57.6\% \times 0.15 \text{ (total road infrastructure cost} - \text{excise tax paid).}$$

In the formula, the total infrastructure cost was calculated on the basis of a Dutch study in 1989. The breakdown of the vehicle tax by category of vehicle is allegedly published by the UK Department for Transport but not indicated. However, it is well-known the correlation the pavement degradation depends with the fourth power from the axle load, so obviously the heaviest categories cause the highest infrastructure costs. In the background calculations of the Directive 1999/62/EC [6], the infrastructure cost of excise duty was found to have been paid for all lorries with a total permissible weight of 12 tons, so a vehicle tax was set only above this limit. The coefficient of 0.15 meant that only 15% of the infrastructure cost not paid by excise duty was planned to be paid as an annual motor vehicle tax. This was planned to be raised to 25% but it was cancelled and in fact it was decreased to 8.6%. In the final directive, lorries with air suspension or equivalent suspension received an additional category discount according to the permissible gross vehicle weight. The values found have remained modest compared to the given methodology and have not even increased in euros in 25 years (!), so the cost of infrastructure is only covered by a declining extent of the excise duty and the vehicle tax, while tolls are playing an increasingly important role. As the EU and Hungarian vehicle tax bases are different and cannot be converted directly, it is difficult to take assess how inconsistent the Hungarian tax rates are with the EU minimum in the higher categories. In most categories, Hungarian tax rates are well above the EU minimum tax thresholds below 30 tonnes. In heavier vehicle categories, where the tax rate expressed in euros may be below the minimum due to the rising euro exchange rate, so the application of the EU minimum may be required, either by repeating EU tariffs in the national law or simply by referring to the Directive.

This would maintain the progressivity of the tax, and even the more categories the EU minimum would have to apply, the more progressivity would be achieved, so the heaviest categories would contribute more proportionally. As pointed out above, the methodology for established EU tax minima is repeatedly outdated and hard to explain, how they were created and why they should be used.

However, this has been the source of law and in any case it is fairer in the progressivity of the tax (at least above 15 tonnes where it is really important) than domestic law that applying only a linear tax rate. We propose to keep the linear tax rates with giving 20-30% discount only to EURO V and VI categories. We also propose to use directly the European minimum rates, if the national tax rate would be lower than that (but 100-120% of the European minimum depending on the environmental categories).

***Toll discount (13%) for large users***

Under the Eurovignette Directive [6], Member States have the option of applying a reduction of up to 13% to the infrastructure charge. Hungarian Toll Act (Act LXVII of 2013), which forms the legal basis of the Hungarian toll system also contains the possibility of a toll reduction, however, there is no detailed regulation of this (it is not clear under what conditions and to what extent it can be used), i.e. even if the possibility provided by law is available, carriers cannot use it yet. At EU level, however, there are Member States that make use of this possibility and have introduced this tariff reduction. In Slovenia, you can get a 10% discount at a fleet level of € 30,000 net per month, while in the Czech Republic you can get a maximum discount of over 13,000 euros per calendar year per vehicle, while in Slovakia you can get a maximum 9% discount (under 12 tons: 11%) over 50,000 km per calendar year per vehicle. From a business point of view, granting a discount may seem like a good solution, but from an environmental point of view, it seems bad at first glance. At the same time, the moderate rate of the discount does not encourage over-consumption, so we can only expect a loss of budget revenue. However the introduction of the large user discount could be economically and environmentally compatible with the Hungarian toll system, if only the trip on the expressway network were included in the discount, thus encouraging using motorways, which would normally be even more expensive but it has lower environmental impact per vehicle, than trunk roads.

## SUMMARY

Due to Hungary's topography, the harmful substances emitted by road traffic, which are dangerous to health, can be cleared out from the atmosphere very slowly, mainly due to rainy and windy weather. However, this is becoming less frequent, and the length of low rainfall periods is also increased by the decrease in the concentration of small particles. As a result, the country's climate development strategy needs to be based on two basic pillars:

1. Reducing the amount of pollutants emitted as much as possible,
2. Gaining financial support for transport greening.

Reducing emissions from road transport can help the first pillar, this means primarily the replacement of diesel-powered buses by buses with electric drive, but the development of the trolleybus network also arises. For this, it is necessary to compare the cost of vehicle acquisition, the construction of the overhead line and the battery charging system, as well as the long-term maintenance and operating costs in a separate expert study. Today's modern trolleybuses can cover a few kilometers without overhead lines, so continuous line construction is not a prerequisite for placing on the line. The trolleybus is a proven, reliable means of transport, has a large passenger capacity (see articulated version) and is more cost-effective than electric buses with current technology. If, in the absence of better data, we start from the Hungarian Tax Authority (NAV)'s 2019 fuel turnover statistics and assume an environmental tax of HUF 2 per litre, then we can count on a source of HUF 9.4 billion per year. We recommend that the support should be implemented on a normative basis. The different forms of support can be summarized, such as the already announced intention to support from the government, the support from the environmental tax, and the possible EU support. Based on market conditions, the amount of environmental tax aid per vehicle should be reviewed at least every two years. All petrol / diesel users could pay, including transport companies, the polluters. From this, we protect the health of the entire living population traveling in larger cities. In public transport there are used approx. 8500 buses, take part, of approx. 2500 of which are the city buses. Companies providing road public transport are typically municipally owned, state-owned, but some companies also have private subcontractors. The vehicle fleet is extremely variable in composition and age. A heavily

polluting bus is common, which in principle should not even travel, but without these the service provider would not be able to provide the required number of vehicles and there would not be a budget available for costly repairs. There are two options to choose from, with either a heavily incense bus running or nothing running instead. Replacement of the vehicle fleet is only possible in the long run and with continuous renewal, on a scheduled basis and the resource requirements are extremely high. By using electric buses and trolleybuses, urban, local emissions can be reduced to zero, and air pollution can be noticeably improved in terms of PM10 and NOx.

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