Emission reduction strategies for the transport sector in Hungary

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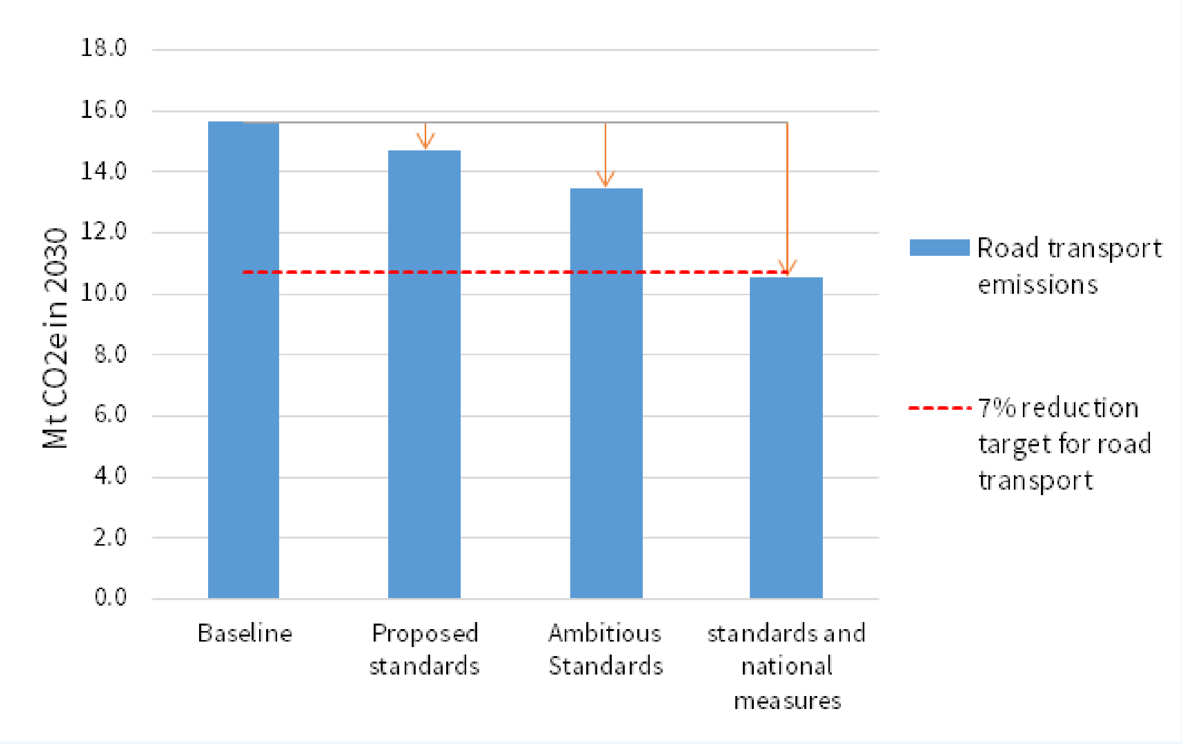
It is the overarching goal of the EUKI to foster climate cooperation within the European Union in order to mitigate greenhouse gas emissions. It does so through strengthening across-border dialogue and cooperation as well as exchange of knowledge and experience.

The information and views set out in this report are those of the author(s) and do not necessarily reflect the official opinion of the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

Executive Summary

Transport is the largest source of greenhouse gas emissions in Hungary. Since 2012, transport emissions in Hungary have been increasing; in the context of needing to be decarbonised by the mid-century under the Paris Agreement, this trend needs to be rapidly reversed. Hungary is already experiencing amplified climate change and warming compared to Europe. The objective of this report is to show how Hungary can decrease their transport emissions using a broad range of European and national measures. In particular, the report focuses on reductions in road transport emissions that fall under the jurisdiction of the European Climate Action Regulation, which enforces a 7% emissions reduction target for Hungary in 2030 compared to 2005 (including all sectors). Finally, policy recommendations are presented to enable Hungary to meet the most ambitious targets.

The effect of mitigating measures such as vehicle efficiency standards, modal shift, and demand reduction, among many others, are calculated using Transport & Environment's in-house transport model, the EUTRM. The main results of the scenarios investigated are shown below. Crucially, Hungary can meet and exceed its 2030 targets as long as ambitious vehicle standards, electrification, and national measures are implemented.



The scenarios in detail:

Baseline: If Hungary takes no action and the proposed 2030 CO_2 standards for road vehicles are not implemented, Hungary will fall short of its 2030 targets by 4.9 Mt of emissions. Under the Climate Action Regulation (CAR, formally the Effort Sharing Regulation) this may result in requiring the purchase of up to 30 million allowances. Assuming that the other sectors just meet their target, no flexibilities, and an allowance price of €100/tonne, this would be €3 billion cumulatively over the 2020-2030 period, if loopholes in the regulation are not used.

Proposed Standards: Even if the European Commission's proposed 2030 CO_2 standards for cars, vans, and trucks are implemented, Hungary will fall short of its 2030 targets by 4 Mt of emissions; the proposed standards would close *the gap* between the target and the projected baseline emissions by only 19%.

Ambitious Standards with Electrification: If the European Commission's 2030 CO_2 standards for cars, vans, and trucks would be strengthened to their technical and economically viable potential, this would mean 40% 2030 CO_2 reduction targets for new cars and vans; for new trucks this would be 43%. Within these standards, the electrification of road transport would be encouraged to ensure the eventual full decarbonisation of the sector. In 2030, sales of electric vehicles would reach 50% for vans, and 30% for trucks. In parallel, all new sales of city buses in Hungary would be electric by 2030. Despite these significant gains, in this scenario Hungary is set to miss its 2030 targets by 2.0 Mt of emissions; ambitious standards would close the gap by 44%.

The scenarios above take into account the number of used cars and vans would be imported from Western countries, the increase in transport activity as the national economy and with it the income of the population will grow. There may additionally be a rebound effect that will work against the efficiency improvements (i.e. as a result of more fuel-efficient vehicles, people will drive more), even though this effect might be rather limited. For these reasons as well as to reduce the gap of the mentioned 4 Mt or 2 Mt, national measures are absolutely necessary.

National measures: There is a wide range of national measures that can help reduce demand and enable shifting to cleaner modes. Measures include shifting car passengers to public transport, walking, and cycling; improving road freight logistics and shifting road freight to rail; and getting more people into each car and bus. Taken in isolation, ambitious national measures could close the gap by 65%; combining national measures with ambitious standards and electrification could see Hungary not only meeting but exceeding the target by at least 0.1 Mt.

Policy Recommendations:

This report cites independent research to set the ambitious levels based on technical and economic feasibility. To realise the full potential of these measures only requires political will. Below is a summary of the key policy recommendations for Hungary to meet its targets.

EU Level:

- Hungary should vote for ambitious vehicle standards in the European Council, and in particular insist on the 2025 targets. For cars, vans, and trucks this is a real 20% reduction by 2025.
- A separate sales target for zero emission vehicles should be agreed for 2025 to drive the supply of electric vehicles in Europe. This can be done either via a dedicated ZEV mandate or by adding a malus to the currently proposed bonus system for cars.

National Level:

- Road charging should be widely implemented: Ensure all tolls are inclusive of separate infrastructure and (air and noise) pollution costs so that more polluting vehicles pay more; change the charging system from time-based to distance-based for passenger cars, and extend it to all roads; extend the toll charge for HDVs to all roads so that the damage they cause is accounted for wherever they drive (this will additionally prevent HDVs from using secondary roads to avoid the toll, and so relieve congestion on those roads). Remove any time-based discounts that encourage inefficient transport behaviour and reduce the environmental implications of the charge.

- To shift car passengers to buses, trains, riding, and walking, Hungary should invest in high quality, affordable public transport and walking and cycling infrastructure, share relevant data with other transport providers and internet mobility platforms to enable Mobility as a Service (MaaS), introduce measures to encourage bike sharing, and reduce the number of car parking spots and increase parking fees.

- To encourage more passengers in cars, introduce city road pricing with measures to disinsentivise car travel such as more expensive parking, facilitate the use of short and long distance car and ride sharing, and adapt fiscal incentives to deter private car use by ending tax benefits for company cars.

- To shift freight from trucks to (electric) trains, eliminate speed restrictions on railway lines, modernise the rolling stock, and improve the flexibility and speed of freight services by investing in rail infrastructure that's not as complex or time-consuming as large cranes, and increase competition in the rail freight market.

- Fuel taxes and tax reform: as a complementary measure to distance-based tolling, Hungary should engage in discussions with neighbouring countries to align their diesel tax rate to that of petrol, and look to increase this to be more in line with the EU average. Collaboration on this measure is vital so as to avoid fuel tourism in which truck drivers divert to re-fuel in the country with the lowest fuel tax rate. This would decrease traffic in certain areas, and make it easier for neighbouring countries to use fuel tax as a tool to reduce greenhouse gases.

Outside the CAR:

- For aviation, at a national level, Hungary should introduce a ticket tax on flights to generate revenues and stem demand. Ending the sector's kerosene tax exemption can be done domestically and through bilateral agreements (if EU wide unanimity to end it is not achieved) a measure that could be initially phased in with neighbouring countries.

- At the EU level, Hungary should support measures that aim to reform the EU ETS as a means of introducing more effective carbon pricing.

- For inland shipping, Hungary should implement tighter air pollution standards for ships and barges calling at Hungarian ports, consider mandates for zero emission shipping on specific domestic routes, make on-shore power supply available, and ensure the transparency and cargo data collection in the EU MRV (when revised) in order to break market barriers to the uptake energy efficiency technologies in shipping.

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1. Introduction and context

1.1. Climate change

Prior to the 1950s, CO_2 concentration levels in the earth's atmosphere hadn't surpassed 280 ppm in the last 400 000 years[i]. On 2 May 2013, the global concentration of CO_2 in the atmosphere reached 400 ppm for the first time over the course of one day[ii]. 400 ppm is significant because it is the central point of the uncertainty zone of the planet for the so-called safe operating space for humanity. The upper-bound concentration for humanity to thrive is 350 ppm, a level surpassed in the mid-1980s[iii] [iv]. As of June 2018, the seasonally adjusted average concentration stands at approximately 407 ppm[v], and rising. The increase in CO_2 is the most important of anthropogenic emissions that increases the amount of heat retained in the Earth's atmosphere and results in climate change[vi]. Climate change pertains to increases in the frequency and severity of natural disasters and droughts, to ocean acidification, temperature change, and sea-level rise, to name a few.

On 12 December 2015, 196 nations around the world adopted unanimously the Paris Agreement that aims to mitigate global greenhouse gas emissions. Specifically, the signatories agreed to take measures to hold the increase in temperature 'to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change'[vii]. This would mean limiting the CO_2 concentration to between 450 ppm and 480 ppm. The European Union, and all its Member States are signatories to this Agreement. For the EU, the Agreement translates to a full decarbonisation of the economy (i.e. no net CO_2 equivalent emissions) by early 2030 to limit warming by 1.5°C, or by 2050 to limit warming by 2°C, compared to pre-industrialisation levels[viii].

Climate change is a global problem requiring global efforts to combat it, however there are specific threats and costs associated for Hungary that have already been observed. From 1981 to 2016, for example, the average summer temperature has increased by 2°C[ix]. At the same time, there is a clear trend towards a reduction in annual rainfall with 30% of the past 20 driest years occurring after 1990 (by chance this would only be 16%). The most extreme summer since 1901 so far was 2007 with three heat waves recorded (a heatwave being defined as the 26.5°C average daily temperature being exceeded for at least three subsequent days)[x]. In the second of these heat waves record breaking average temperatures of higher than 30 were recorded for five subsequent days; during this period, the excess mortality rate was 57%[xi]. Changes forecast for Hungary in which GHGs increase at their highest predict warming in every season, but particularly in summer with an average 4-5°C warming for the period 2071-2100 (compared to the average in the period 1961-1990)[xii]. The summer of 2018 was the 7th most extreme summer since 1901, with average temperature 1.6°C higher than the average for the years 1981–2010.[xiii] Five of the other extreme summers also occurred during the last 15 years.[xiv]

Climate change is a global problem caused by human activities that has and will have increasing environmental, social, and economic costs. As the 62nd largest emitter in the world[xv], and the 16th largest emitter in Europe[xvi], Hungary must play its role in reducing greenhouse gas emissions to avoid catastrophic climate change. The measures necessary to reduce its emissions accordingly would also create a competitive advantage for Hungary and improve its prestige on international level. *This report will detail a roadmap that will enable Hungary to meet its climate obligations for the sector responsible for most of its emissions: transport.*

1.2. Scope of this report

The main legal framework that this report is based on is the Climate Action Regulation (CAR)[xvii], formally the Effort Sharing Regulation (ESR). As will be described in greater detail, the GHG emissions that fall within this regulation and are at the same time the focal point of this report is land transport, i.e. passenger transport in cars, trains, and buses and freight transport in trucks and trains. Motorcycles and scooters are not considered in this report as they are a small percentage of road transport emissions and they have a clear and proven decarbonisation pathway through battery electric powertrains. The report will look at measures that can be taken to decarbonise these sectors and in particular will use T&E's in-house transport model to show how much reduction is possible from these measures in reaching the 2030 target.

In this sense, the report will show the impact of what is accepted as technically possible in terms of some measures like the fuel efficiency improvement of vehicles, but also what is required to shift or reduce demand of transport. The emissions from shipping and aviation will also be discussed, but their emissions will not be modelled, among other reasons because they are not included under the CAR. Finally, for all of these modes of transport, this report offers pragmatic, technically feasible, and economically viable policy recommendations to pave the pathway for not only the achievement of the Hungarian 2030 emission reduction targets, but policy that will make the ultimate decarbonisation of transport an attainable reality by the mid-21st century.

1.3. Why does this report differ from other reports

Due to its poor energy performance, Hungary has been the subject of a number of reports offering insight and analysis into how to decarbonise the economy. While the majority of these focus on the energy sector, it is worth mentioning four in particular: an E3G country report (2017), a report by Energiaklub (2015), a paper by ECF and CAAG (2015)[xviii], and a paper by CAAG (2018)[xix].

The E3G report (2017)[xx], forming part of a series of briefings on the four Central European states known collectively as the Visegrad Group, assesses the political economy of Hungary with regards to low-carbon transition. The paper notes that Hungary is highly vulnerable to climate change, in particular to heat waves and inland floods. It is stressed that with 80% of public investment between 2011-2013 coming from the EU, and relatively limited national climate ambition, the EU is a key driver of climate mitigation in Hungary. Despite some useful insights, the report doesn't provide much analysis of how emissions can be reduced in the transport sector.

A second report by Energiaklub (2015)[xxi] comprehensively analyses energy transition and possibilities for decarbonisation with a focus on developing an alternative vision to the proposed new nuclear power plant (Paks II). The study reports that all of Hungary's energy demand in 2030 can be fulfilled through energy efficiency improvements and decentralisation, with 27% of energy coming from renewable energy plants (and without the need for the new nuclear power plant). Interestingly, the study suggests a lower energy demand increase of 40.2 TWh in 2012 to 47.1 TWh in 2030 than that reported in official figures (50.6 TWh); the authors' 2030 vision additionally includes a 30% shift in road to rail freight and suggests that 120,000 of the 4.3 million cars will be electric (25% of which will have smart chargers activated when there is excess electricity on the grid). One drawback of this report, however, is its relatively limited input on transportation which briefly mentions potential for increased rail freight and electric cars but does not discuss aviation or shipping (though it certainly provides a deeper analysis of this sector than the E3G paper mentioned above).

The paper by ECF and Clean Air Action Group (CAAG) (2015)[xxii] presents a mix of qualitative and quantitative research based on a series of interviews with stakeholders focusing solely on the decarbonisation of transport in Hungary. The paper suggests that one of the main causes of the decrease in rail freight in recent years has been the diversion of Russian cargo to Slovakia following the situation with Ukraine. Interestingly, while the introduction of the electronic truck toll in 2013 was expected to result in a 6% shift in freight from road to rail (based on international statistics), the paper states the shift was insignificant (possibly reaching 2%); moreover, it says the toll doesn't add significant additional costs to truck freight and - as it is only applied on a few roads - allows toll avoidance for many trucks. While the interviews are insightful, they don't present a full analysis of the current situation across the transport spectrum, and moreover don't provide modelling for what emission reductions current and future policies could achieve.

Finally, the report by CAAG (2018)[xxiii] in the context of the EUKI project analyses national policy measures for transport that have been implemented in Hungary with recommendations on how to improve them, along with recommendations of national measures that should be introduced or expanded. Although the report does not have emissions projections, the range of measures that are considered are integrated for the modelling projections in this current report.

This paper, therefore, fills a gap in the literature by presenting decarbonisation strategies focused solely on transport and based on updated in-house modelling. In the last year alone in Hungary, CO_2 emissions have increased by 6.9%, well over the EU average of 1.8%[xxiv]. Given this and the above, this report is timely in its analysis of transport policies and provision of decarbonisation strategies.

1.4. Transport & Environment and the EUKI project

The European Climate Initiative[xxv] (EUKI, from German Die Europäische Klimaschutzinitiative) is a project financing instrument by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMUB). The overarching goal of EUKI is to foster climate cooperation within the European Union in order to mitigate greenhouse gas emissions. It does so through strengthening cross-border dialogue and cooperation as well as exchange of knowledge and experience[xxvi]. Under the EUKI initiative, T&E is undertaking a project called "Delivering the EU-2030 and Long Term Climate Objectives in Central, Eastern and Southern Europe, with a Specific Focus on Transport"[xxvii], which has four overarching objectives, namely:

1. To provide accurate information on the potential of transport decarbonisation measures to meet climate targets in the targeted countries.
2. To foster NGO led development of national climate and energy plans
3. To enhance or create communication and exchanges between national organisations for target countries
4. To identify additional savings through EU funding and measures - transformational projects in the transport sector

Transport & Environment coordinates this project which involves research and dissemination at national level in close collaboration with some of our national partners in Southern and Eastern EU Member States, specifically Hungary, Italy, Romania, Spain, and Poland. Transport & Environment has more than 28 years expertise on transport decarbonisation policies and, thanks to that, T&E is uniquely placed to gather evidence, critically analyse, and recommend clear policy pathways to achieving decarbonisation of the transport sector[xxviii] from an impartial perspective.

1.5. Introduction to EUTRM

Transport & Environment has used its in-house model, the European transportation roadmap model (EUTRM) to analyse the effect of different policies on GHG emissions. The EUTRM is a demand driven bottom-up model that can compute GHG emissions in five year intervals, but has recently been modified to compute at yearly intervals for the years between 2016 and 2030. Passenger transport and freight demand are based on purchasing power parity (PPP) adjusted GDP, which is determined by historical and projected gross domestic product (GDP), population, and fuel price for each country. All transport demand within a Member State is met with effectively unlimited transport capacity for freight but with natural limits on motorisation rates for passenger cars through new or second hand sales.

The EUTRM is initialised and calibrated with historical data. For the example of trucks, the vehicle stock and number of new vehicles (both in number and in weight category), mileage, fuel consumption, transport activity, and load factor are considered. The bottom-up structure allows for vehicle based policy changes. Continuing the example of trucks, these can include policy driven modal shift (moving freight from road to rail), engine technology uptake (hybrid, electric, hydrogen), fuel efficiency (efficiency standards or market development), and logistical improvements (increase in load factors, the amount carried by each truck). Therefore, the strength of the EUTRM is in its ability to combine multiple policy decisions and show their effect on the business as usual case, and to quantify the relative importance of policies on GHGs.

Note on modelling fuel efficiency improvements: Cars and vans are type-approved by a laboratory test, known as the New European driving cycle (NEDC), to give a standardised method for determining fuel efficiency. Developed in 1997, a vehicle is placed on a chassis-dyno and the technician follows acceleration and braking patterns from approximated driving profiles based on urban/city driving, country road, and highway driving. The gap between what is measured in the lab during type approval and on the road was about 10% in 2000, however in 2017 it had grown to what appears to be a fleet average ceiling of 42%[xxix], for a number of reasons[xxx]. The introduction of the new test cycle (the WLTP, the worldwide harmonised light vehicles test procedure), should partially help this, as the driving profiles are much more representative than in the NEDC. Aligning NEDC fuel consumption results with those measured with WLTP will vary between manufacturers and cars, and will not be known until 2019 and 2020 as the new WLTP regulation comes into force. This is one of the reasons the Commission opted for percentage reductions rather than g CO_2/km figure; the efficiency improvements should be as much as possible real world improvements. When modelling car fuel efficiency in this report, reductions are based on NEDC fuel consumption and the gap is kept constant at 42%.

1.6. Baseline situation, modelling assumptions and projections

Projecting Hungarian emissions in 2030 relies on the historically observed relationship between wealth and transport demand[xxxi]. As will be shown, holding this assumption and without explicit measures to reduce the fuel efficiency of vehicles, an increase in the economy will lead to an increase in transport activity and thus an increase in emissions. The key socio economic assumptions that are exogenous and static inputs to the EUTRM are detailed in Table 1. These assumptions are in line with the Commission's Reference Scenario[xxxii] although in 2050 the activity levels in the EUTRM are 5-10% higher. In 2016, the inputs are closely aligned with the data from the Statistical Pocketbook: EU Transport in Figures, 2018 (with 56.7 G p-km in passenger cars, and 24.5 G t-km of road freight, measured by territoriality[xxxiii]).

Along with these assumptions, the oil price is kept constant. This assumption alone is the single most import difference between the projections of the Commission's 2016 Reference Scenario and the EUTRM in 2050: an increase in oil price makes transport more expensive, limiting demand and according to the report incentivises manufacturers of cars and trucks (OEMs, original equipment manufacturers) to produce more efficient vehicles, despite no historical evidence of this[xxxiv]. The oil price is kept constant in the EUTRM for two main reasons, firstly, to negate an otherwise uncontrollable and external influence on transport demand, and secondly, as if the EU and indeed the world do begin to take a trajectory of decarbonisation, the demand for oil will decrease, and from simple economic principles, price will not go up.

Table 1: Main socio-economic assumptions for Hungary in the EUTRM

Metric	2016	2020	2030	2050
Population (millions)	9.8	9.8	9.7	9.3
GDP (2013 € billions)	115.0	123.2	152.5	202.2
Passenger car activity (G p-km)	53.9	59.7	81.8	98.1
Road Freight activity (G t-km)	20.9	22.8	30.2	45.7

In the baseline, only fully legislated policies are included. The only law directly pertaining to the efficiency are the 2021 car and 2020 vans standards; these standards are included in the model. The monitoring and reporting regulation (MRV), a measure that will allow hauliers to compare like trucks against each other and choose the most fuel efficient for their operations, is assumed to increase large truck (>16t) fuel efficiency by 10% between 2010 to 2030[xxxv] and 6% for smaller trucks[xxxvi,xxxvii]. Other proposed legislation, such as the Commission's proposal on truck CO_2 standards and the 2030 standards for cars are still being debated in the European Parliament and Council. As they are still subject to change, these are not considered in the business-as-usual baseline. In terms of national law, despite the many options available, Hungary has implemented laws that will contribute to the decarbonisation of transport only to an extremely limited extent. These options and their implementation will be explored in the following sections. In short, the baseline presents a business-as-usual scenario; there will be no transformational and disruptive changes to the transport system, but a steady increase in demand and thus emissions will be observed by all modes.

When modelling the effects of more fuel efficient vehicles, the rebound effect is not considered. This is for a number of reasons, most importantly that it is assumed that national measures (as described later in this report) will fully compensate for any potential rebound. Additionally, there is evidence that the rebound effect is reducing, and that the rebound elasticities can be quite low[xxxviii,xxxix].

1.7. Who should read this report

National level NGOs

NGOs that represent civil society with a focus on climate change and decarbonisation of the economy, ideally with experience on national and EU climate regulations. This report should be considered as a handbook on how to navigate the often complex legislation concerning climate, decarbonisation and sustainable transport with an aim contributing actively and positively to decision-making processes on these matters.

Decision and policy-makers at national, regional and local level.

Lawmakers at all levels have the responsibility to design and implement policies that must deliver greenhouse gas emission reductions in order to achieve the nation's and the EU's climate commitments. This report should for them be seen as technical and policy input, which offers accurate, positive, plausible options for the decarbonisation of the transport sector.

Private sector and individuals

European companies are world leaders in clean technology, to remain so requires ambitious regulatory framework that will not only keep European companies there, but will push for innovation and novel solutions.

Individuals, ultimately, hold the most power. Voting either at the ballot box or with your wallet gives signals to lawmakers and private companies that a sustainable, decarbonised future is what we need and what we want in order to secure our future. In a world full of information, this report aims to gives honest, accurate accounts and recommendations for an ambitious but feasible roadmap for 2030 and to the mid-century.

2. Environmental and political climate in Hungary

2.1. The steady decline of emissions in Hungary

This section will describe the last quarter of a century of emissions in Hungary, the dominant and fast growing sectors, and the upcoming legislated targets and decarbonisation ambitions. From 1990, Hungarian greenhouse gas (GHG) emissions from all sectors (including ‘bunkers’, those emissions from international aviation and shipping) decreased from around 92 Mt CO_2e to 61.2 Mt CO_2e (Figure 1). These reductions came in two steps: the first occurred after the first democratic elections since the fall of the Soviet Union, where the removal of state subsidies, rapid privatisation, and austerity measures led to sharp decline in industrial output. The global financial crisis of 2007 and 2008 also led to a sharp contraction in emissions; as the economy contracted, demand for goods, transport, and electricity and heating reduced along with their associated emissions. Since 2013, however, Hungarian emissions have increased by 7.6%. Crucially, from here on in, will Hungary be able to decouple economic activity with emissions or will they increase again as the economy reinvigorates? The largest emitting (and since 2013, the fastest growing) sector is transport with a 21.4% share in 2016, from which 20.4% is generated from domestic transport (i.e. road, rail, and domestic aviation and shipping). This represents a marked change from 1990 where the transport emission share (10.2%) was less than industry (30.9%), buildings (24.2%), and public electricity and heat (19.6%).

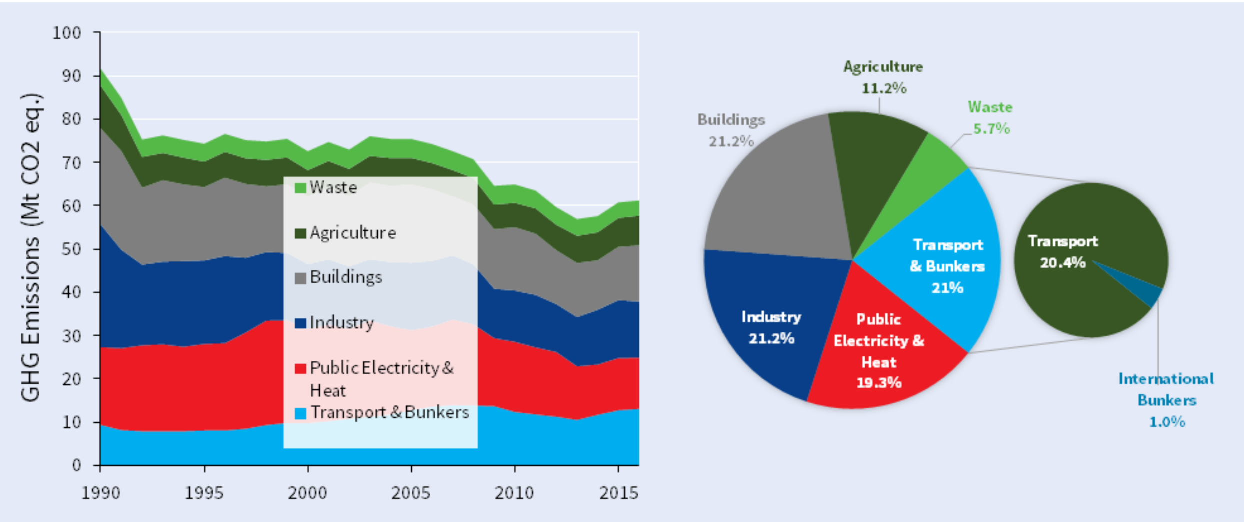

Figure 1: evolution and 2016 share of Hungarian CO_2e emissions. Source: UNFCCC reporting[xl].

2.2. European climate law for GHG emissions

In this section the environmental laws applied by the European Union that Hungary must abide to are introduced and discussed. In general, the laws set Member States or specific installations targets, with fines or severe expenses incurred for not meeting the reduction target.

2.2.1. Emission trading scheme (ETS)

The European Union emissions trading system (EU ETS) is a scheme to reduce CO_2 emissions by trading and selling emissions permits on a free market where the availability of permits (and hence allowable emissions, reduces over time. The system operates in 31 countries (all 28 EU countries plus Iceland, Liechtenstein and Norway) and limits emissions from more than 11,000 heavy energy-using installations (such as power stations and metal factories) and, since 2012, airlines, although only for flights within Europe. The most relevant sector to this report is aviation.

2.2.2. Effort Sharing Decision (ESD)

The Effort Sharing Decision, one of the key instruments of the EU to mitigate climate change, was established in 2009 and sets emission reduction targets for each Member State for the sectors not covered under the EU Emissions trading system. The law is in force for the period 2013-2020. The collective reduction target for the EU as a whole is 10% by 2020 compared to 2005; Hungary's target was to limit growth to 10%. The targets were established based on GDP of the countries[xli][xlii]. This means some richer countries have reduction targets of 20% while other countries had to limit their emissions growth to 20%. Member States must ensure that their emissions are less than the trajectory made from the average of their 2008, 2009 and 2010 emissions in 2013, then tracing a straight line to the 2020 target[xliii]. From Figure 2, it appears likely that Hungary will meet its 2020 targets and, in particular, is well on track to meet its ETS targets. In addition, as Hungary is overachieving on its ESD sector emissions, it will have plenty of allowances banked, so they will not foreseeably have to buy any allowances to make their target. Increasing emissions to this level should not be Hungary's ambition, however, as this will make meeting the reductions over 2021 to 2030 much harder, as seen in the following section.

2.2.3. Climate Action Regulation (CAR)

The EU has just finalised the process on the piece of legislation that continues the ESD and sets the emission reduction targets for member states for the period 2021-2030[xliv]. This time however the emission reduction targets are tighter - the overall reduction target for the EU in 2030 for the non-ETS sectors is 30% by 2030 compared to 2005 levels. The regulation includes flexibilities such as using ETS allowances and access to credits from the land use sector[xlv]. Hungary can reduce its target by 0.4% from this flexibility alone[xlvi]. While flexibilities make it easier for Member States to achieve their targets, they are worse for the climate because it will be by credits, not real emission reductions, to meet the targets.

The banking and borrowing mechanism of the CAR is based on comparing reported emissions for a given year compared to a straight line drawn to the 2030 target. If emissions are below the line, the country is overachieving its emission reduction objectives and can bank (or sell) a part of the difference. Similarly, if reported emissions are above the line, a country can borrow (or buy) a limited part of the future allowances to comply with the yearly target.

A complexity of the CAR is the so-called starting point for calculating where to start drawing this straight line - the trajectory to the 2030 target from which the annual balance will be calculated. This will determine how many emission allowances a country will be able to bank from the first year, 2021. In April 2018, the decision on how to compute the starting point for emission allocation was formalised[xlvii]. The starting point baseline (i.e. the amount of emissions) is computed as the average of greenhouse gas emissions during 2016, 2017 and 2018. The starting point also has a time dimension. This will be either the reported average emissions in May 2019, or the average of 2016, 2017, and 2018 emissions in 2020, whichever results in a lower allocation. Taking the starting point resulting in the lowest allocation is positive for the climate but difficult for Hungary, as urgent measures will be required to avoid having to buy emission allowances from overachieving countries. This report makes no assumption in regards to achievements made in the ETS sector, instead focusing on emissions regulated by the ESR. A fundamental difference between these two lies in the control of allowances; under the ETS, trading of allowances is carried out by installations themselves, whereas, under the ESR, allowances are the responsibility of the countries.

Finally, the CAR includes an extra flexibility instrument called Safety Reserve, which is essentially a pool of credits worth 105 Mt CO_2e. To access it, Member States have to meet a series of requirements, namely: have a 2013 GDP per capita below the EU average; not exceed their emission allocations in the period 2013-2020 (i.e. overachieve their targets); and exhaust the other available flexibilities. If these conditions are met, the country can access an amount of the credits in the safety reserve, not exceeding 20% of its overall overachievement in the period 2013-2020. Based on these conditions, Hungary is likely to gain access to this flexibility mechanism, however the amount of extra credits for Hungary is uncertain for the moment.

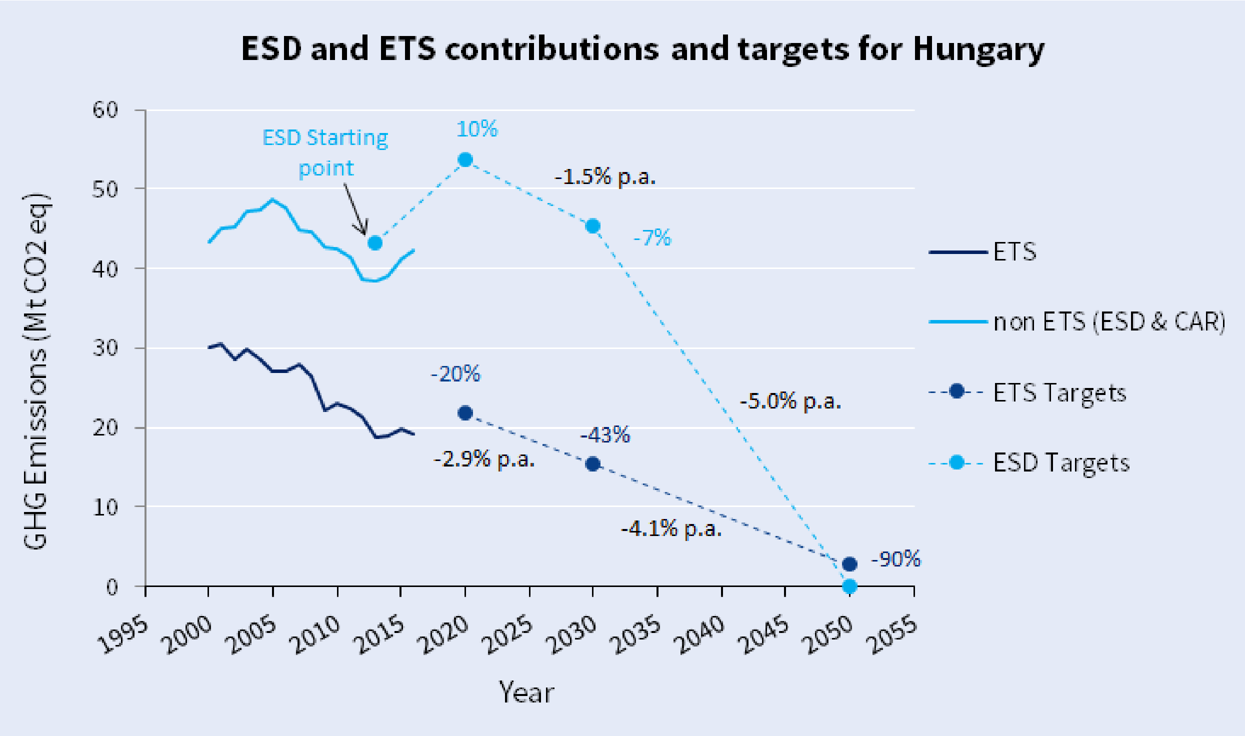

Figure 2: Evolution of Hungarian ETS and ESD emissions. Source: UNFCCC reporting and EEA contributions of sector allocations.

2.2.4. Renewable Energy Directive (RED)

The Renewable Energy Directive (RED)[xlviii] established a policy for the production and promotion of energy from renewable sources in the EU[xlix]. The relevance for transport is that all EU countries must ensure that at least 10% of the energy used in transport (via biofuels or electrification) come from renewable sources by 2020. Although the RED is not specifically a climate law, its goal of increasing the share of renewable energy will see benefits for the climate. The REDII, which formally ended negotiations in June 2018, is the revision of the RED and will apply from 2021 to 2030. The REDII sets a binding target for advanced fuels, which include advanced biofuels, renewable electricity, hydrogen, etc., in an attempt to promote the use of sustainable and cleaner forms of transport. In addition, the EU is slowly moving away from food-based biofuels that are unsustainable and have negative impacts on climate and environment[l], by eliminating a binding target for food-based biofuels and setting a limit on their use.

The use of advanced fuels will be promoted thanks to the binding target of 7% established on the REDII. Furthermore, the use of advanced biofuels and electricity will be multiplied by 2 and 4 times respectively, to make it more attractive for Member States and boost the support. Importantly, in terms of CO_2 emission accounting, renewable fuels are zero rated.

It is up to each Member State to decide the policies to pursue to reach (or exceed) this target; to date, Hungary has not indicated an intention to exceed this target. In 2016, Hungary's overall renewable energy share was 7.4%[li]; the contribution from food based biofuels was 119 ktoe, or 2.7% of energy, so a little under half of the 7% cap. Advanced biofuels made up 67 ktoe, or 36% of liquid biofuels. Renewable electricity in rail was 27.0 ktoe while in road it was 0.6 ktoe. Applying the corresponding multipliers makes the total renewable energy share (RES). If these trends from 2013 to 2016 were to continue, food-based biofuels would remain stable at 2.7%, thus a 2030 limit of 3.7% will apply to the Hungarian fuel mix. In this report the biofuel share is assumed to stay constant from 2016 levels, mainly due to no indication from the Hungarian government as to whether there is a policy to actively increase this share. This report will not be exploring the best ways for Hungary to reach its 2030 REDII target.

2.3. Global law for aviation and shipping

2.3.1. Maritime and IMO

As a land-locked country, Hungary has no direct international shipping activity. Inland shipping activity (which falls outside of the jurisdiction of IMO) has remained largely constant since 1990, at 2.0 btkm. In terms of emissions, they have decreased from 29 kt CO_2 eq. in 1991 to 13 kt CO_2 eq.

2.3.2. Aviation and CORSIA

Domestic and intra-EU flights are covered by the EU-ETS, a system which continues to underprice carbon and whose declining cap remains out of sync with the reductions required by the Paris Agreement. Flights to and from third countries (outside the EU) are not covered by any climate measure. Rather, parties to the International Civil Aviation Organisation (ICAO), the UN aviation agency, agreed to adopt a global market-based mechanism (CORSIA; carbon offset and reduction scheme for international aviation) to offset aviation emissions above 2020 levels. CORSIA won't reduce emissions from the aviation sector - the objective is to purchase emission reductions from other sectors. However even that limited objective won't be achieved, as the system is likely to be flooded with worthless offset credits and airlines will be permitted to burn biofuels with few sustainability criteria in place. Offsetting has been proven to be a discredited mitigation measure. The European Commission's own research[lii] has found that only 2% of offset projects actually delivered emission reductions"

Passenger traffic to Hungary has seen double digit year-on-year growth since 2013, or 58% more departing flights in 2017[liii]. Part of this growth has been attributable to WizzAir that has opened up services in Eastern Europe and is based in Budapest. Air cargo in 2017 saw similar growth with a 13.4% increase from the previous year to reach 127 kt[liv]. In 2017, the number of passengers in Hungary whose journey would have been covered by CORSIA was approximately 1.4 million, compared to 5.4 million intra-EU passengers. Most intra-EU passengers fly to and from the UK (2.0 Million passengers in 2016) and Germany 1.7 million passengers). While these passengers pay the air passenger duty (APD) of £13 from the UK and the *Luftverkehrabgabe* of €7.46 from Germany, raising substantial revenues for those countries, flights from Hungary have no such tax and thus Hungary loses considerable revenues. A ticket tax will have the benefit of raising revenues which can be used to put downward pressure on demand. At the same rate as the German ticket tax, Hungary could have earnt €40 million on intra-EU flights, and €32 million on extra-EU flights (assuming no change in passenger demand) in 2017.

2.4. History of climate mitigation in Hungary

2.4.1. National law, strategies and concepts

Hungary has prepared and/or adopted several national strategies and concepts, however, their implementation is lacking. Most of the laws adopted during the last 10 years did not have much effect on the decarbonisation of transport, and in some cases, they had just the opposite effect. Some of the most important documents are the following:

- Second National Climate Change Strategy (Nemzeti Éghajlatváltozási Stratégia)[lv]: This was adopted by the Hungarian Parliament on 30 October 2018. The draft now places as much emphasis on mitigation as on adaptation with an outlook up to 2050. The Strategy broadly suggests that by 2050 CO_2 emissions must be reduced by between 52% - 85% compared to 1990. Although the Strategy is very progressive in describing the necessary measures in general, it foresees no concrete measures. For example, it envisages the reduction of transport demand by traffic calming, further development of the road toll, making public transport more attractive, conducting awareness raising campaigns, etc., but it does not elaborate at all on how and when all this will be done and what results are foreseen e.g. in the coming 5 or 10 years.[lvi].
- National Energy Strategy (2011): The report states that increasing the share of electric (road and railway transport) and hydrogen-based (road transport) transport to 9 percent and that of the share

of biofuels to 14 percent by 2030 serves the purpose of reducing the oil dependency of transport. And notes that the transition of community transport to locally generated fuels, meeting the sustainability criteria (second-generation technologies, biogas, hydrogen and electricity) will also contribute to the achievement of the Energy Strategy objectives

- Decree amending the rules on Wind Energy Installations[lvii]. This regulation (277/2016. (IX. 15.) adopted by the government restricts the construction of wind turbines within a 12 km radius of residential areas (effectively banning their construction across the whole country).[lviii]
- Alternative Fuels Infrastructure Directive, "AFI Directive": approved on 16 December 2016 and published on 13 January 2017, the directive mandates Member States to publish their National Policy Framework detailing the plans for the development of the national infrastructure to supply alternative fuels (electricity, LPG, CNG, hydrogen and biofuels). According to the directive, by the end of 2020, there should be an adequate number of public electric vehicle recharging stations, in accordance with the forecasted number of electric vehicles circulating. Hungary's NPF[lix] focuses on installing many electric charging points and quite a number of natural gas filling stations during the next few years, and envisages substantial government support for these infrastructure investments.
- National Transport Infrastructure Development Strategy (Nemzeti Közlekedési Infrastruktúra-fejlesztési Stratégia, NKS)[lx]: It foresees the decoupling of economic growth and transport performance as well as developing sustainable urban transport systems and other measures to reduce environmental pollution from transport. However, there are no concrete figures on when and how these measures will be implemented, how much they cost and how will they be financed. The Strategy also foresees implementation of measures which would be harmful for the climate (road construction, airport development). According to its Strategic Environmental Assessment, the Strategy focuses rather on [traditional] economic development instead of environmental goals.
- Jedlik Ányos E-Mobility Action Plan[lxi,lxii]: It envisages promoting electromobility through various measures: tax breaks for electric cars, free parking for cars with green licence plates (electric and híbrid cars), construction of charging stations etc. One of the results was that the Budapest Municipality has permitted cars with green license plate to park for free throughout the Budapest area since 1 January 2016 (where previously parking for free was only allowed while charging).
- National Nuclear Research Program: Approved in 2015, the program sets aside €6.2 million (1920 million HUF) for nuclear research projects.
- Sustainable Urban Mobility Plans (SUMP): Many cities, including Budapest, have a SUMP as this is a pre-condition for receiving EU funds for transport developments. However, these SUMPs tend to be general, and tend not to contain deadlines for implementation, nor concrete targets.
- Action Plan for Improving Energy Efficiency of Transport (2013-2020) (Közlekedés Energiahatékonyság-javítási Cselekvési Terv 2013-2020)[lxiii]: The Action Plan lists several measures to decarbonise transport. However, it states that until 2025 the main instrument for this purpose is to increase fuel-efficiency. It also foresees that road pricing, intelligent urban planning, and transport planning will also play an important role later on. As the most important measure to increase fuel efficiency, the Action Plan urges an increase of the share of diesel cars, and calls attention to the fact that in Hungary the share of diesel cars is (in 2010) only 20% which is much lower than in most Western European countries. Another measure could be the increase of the share of biofuels. The Action Plan also mentions that the number of hybrid and electric cars should also increase as a long-term solution, and that CNG/LNG will be a mid-term solution. The roll-out of infrastructure (including ICT applications) is needed to support this.

2.4.2. Road charging

Hungary has two systems for road charging, one for passenger cars and vans (up to 3.5 tonne of permitted total weight), and another for trucks. Both systems operate only on motorways and some other main roads. Cars and vans are charged according to a time-based system, using a so-called 'vignette'. Austria, Bulgaria, the Czech Republic, Romania, Slovakia, Slovenia and (soon) Germany[lxiv] all use this system for passenger cars. This allows users to drive as much as they would like within a given time period. Trucks, on the other hand, are charged using the distance-based system; this means that they are charged per kilometre that they drive. Since 2013, the electronic, distance-based toll system has operated on 6 500 km of motorway, highway and main routes in Hungary. The external costs of trucking can be significant in terms of pollution[1], and for infrastructure wear and tear, noise, and congestion[lxv]. This distance-based system more accurately captures the infrastructure damage caused by road users as it accounts for every kilometre driven. It moreover encourages more efficient transport behaviour, and as such reduces pollution.

Tolling can play an important role in the uptake of cleaner, more fuel efficient vehicles and ZEVs. Firstly, applying CO_2 differentiation of road charges based on tailpipe emissions would complement and gradually replace differentiation based on air pollution. For cars, EURO class differentiation should play a role but it must be based on Real Driving Emission test results and not on the discredited laboratory tests. For these reasons, Hungary should change their road charging for passenger cars in line with that for trucks and differentiate according to EURO class. Currently, only the toll charge for trucks is differentiated according to EURO class[lxvi]. The differentiation, however, is not significant, and moreover, the categories account for multiple class of EURO in one. In fact, there are just three categories of environmental classification: Group 1 consisting of EURO III and above; Group 2 consisting of EURO II; and Group 3 consisting of EURO I and EURO 0. The development of the EURO III class for heavy duty vehicles in 2000 introduced explicit limits on NOx, and this has been dramatically reduced since. The move from EURO V to EURO VI saw a significant reduction in NOx (up to -80%) and particulate mass (-66%)[lxvii]. By charging these truck classes – together with EURO III and EURO IV – the same rate for their road use, the Hungarian government fails to effectively incentivise the uptake of cleaner trucks, and as such misses out on an opportunity to reduce air pollution. Moreover, there is roughly only a 0.05 EUR / km difference between the rate charged for the most polluting category and the least polluting category of truck (with two axles)[lxviii]. By comparison, the most polluting German trucks (with two axles) are charged 0.08 EUR / km more than the least polluting equivalent[lxix]. A redesign of the toll charge therefore should ensure effective differentiation between each of the EURO classes that accurately accounts for the pollution caused by those vehicles.

Finally, the HDV toll should be extended to apply to all roads. A study performed for T&E showed that in the EU, trucks are responsible for €143 billion in infrastructure and external costs but only cover 30% of such costs[lxx]. The economic burden of extending the toll for truck companies would be very low as transport and logistics companies have been shown to pass on around 85%[lxxi] of tolling costs to clients. For those clients who pick up the bill, transport is between 2-5%[lxxii] of production costs, and the road toll would constitute only a small part of the transport costs. So tolling does not place an unbearable burden on trucking companies or businesses. In fact, tolling HDVs on all roads would ensure that the damage they cause in terms of infrastructure and pollution is captured no matter where they travel, and, in addition, would reduce congestion on secondary roads as toll-avoiding HDVs return to motorways (which tend to reduce journey times).

2.4.3. Environmental performance of transport

In this last piece of historical analysis, a closer look is taken at how Hungary has decarbonised its economy, if at all. Historically speaking, economic growth (that may be measured by gross domestic product) leads to an increase of transport activity. Figure 3 shows exactly this trend: a GDP[lxxiii] that increased from 1995, both passenger transport (measured in passenger kilometres, p-km) and road freight activity (measured in tonne kilometres, t-km) increased[lxxiv]. In this figure, TOT indicates total transport by Hungarian trucks both domestically and internationally, while TER refers to territoriality, which is the amount of freight activity within Hungary's borders. After the financial crisis, both activity and emissions dipped with the contraction of the economy.

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[1] For pre-Euro 6 vehicles.

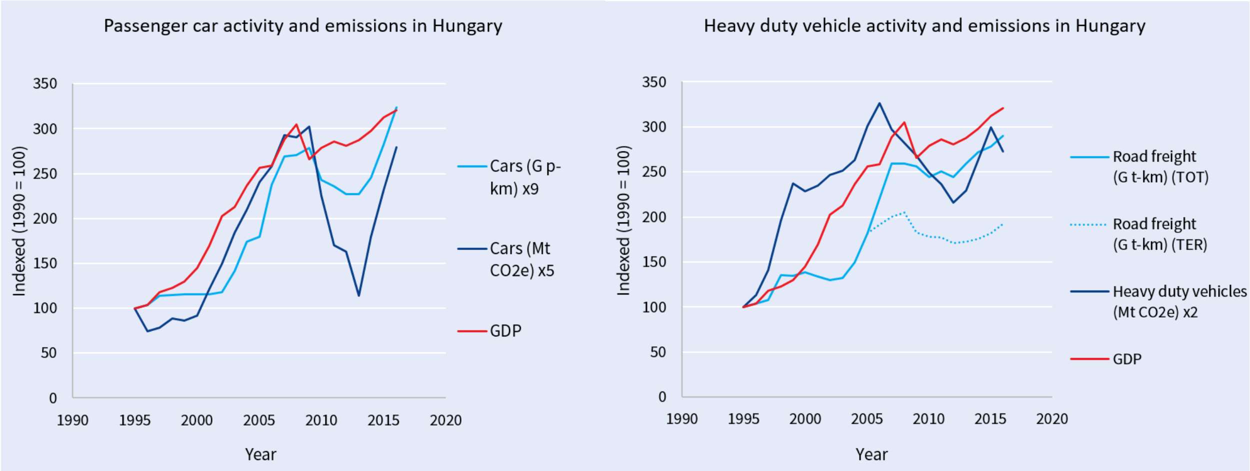

Figure 3: Evolution of Hungarian GDP, transport activity and emissions. Note that the car passenger activity has been scaled with a factor of 10, car emissions with a factor of 5, and heavy duty vehicles emissions with a factor of 2 to aid visual comparison.

In order to see if a decoupling of emissions and activity has actually occurred in the last 20 years, the environmental transport performance is shown in Figure 4. While in the EU28 as a whole the passenger km of activity per emission has been steadily increasing (i.e., more passenger movements per unit of fuel burnt), the Hungarian car fleet has seen large variations, from 10 pkm/kg CO_2e in the late 90s compared to 8 pkm/kg CO_2e from 2005 to 2010. Currently the passenger performance of Hungary is equivalent to the EU average. For road freight, Hungarian environmental performance measured by territoriality, i.e. the transport activity recorded by trucks moving within the national boundaries, has been sitting under the EU average, although in the 2016 this was close to the EU average of 8 tkm/kg CO_2e.

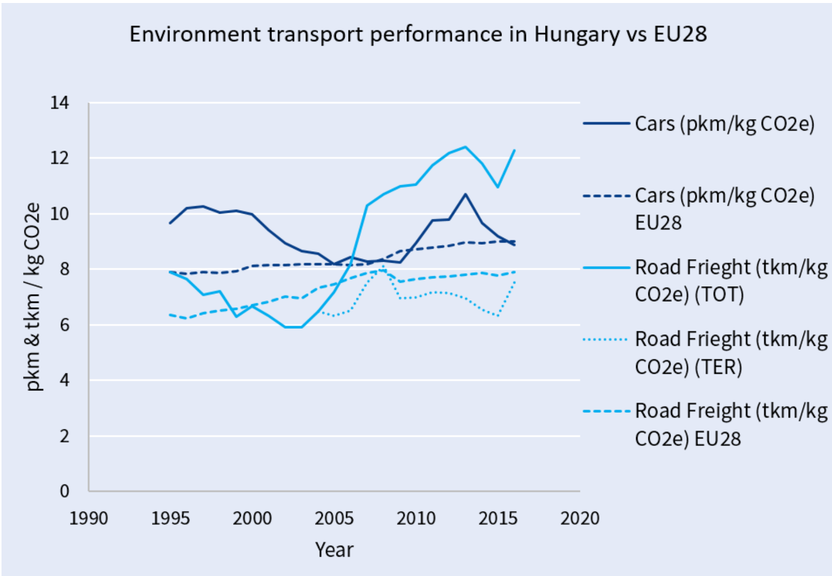

Figure 4: Comparison of the evolution of Hungarian environmental transport performance against EU 28 average[lxxv].

2.5. Where will Hungarian transport be if no action is taken?

In terms of emissions, road transport in Hungary[2] is on a trajectory to exceed its 7% CAR reduction by 4.9 Mt (Figure 5) in a business-as-usual scenario. Here lies another important assumption of this report: the equal distribution of reduction effort across sectors in the CAR. In publications released by the European

[2] Not including emissions from motorcycles

Commission, it is stated that transport in the EU should only reduce its emissions by between 18% and 20%[lxxvi]. As the biggest sector in the CAR, and a sector where clear technological pathways exist for decarbonisation, it is surprising that the industry and building sectors need to reduce their emissions more than transport. The authors of this report would argue that transport should achieve *at least* the CAR target, and beyond where possible.

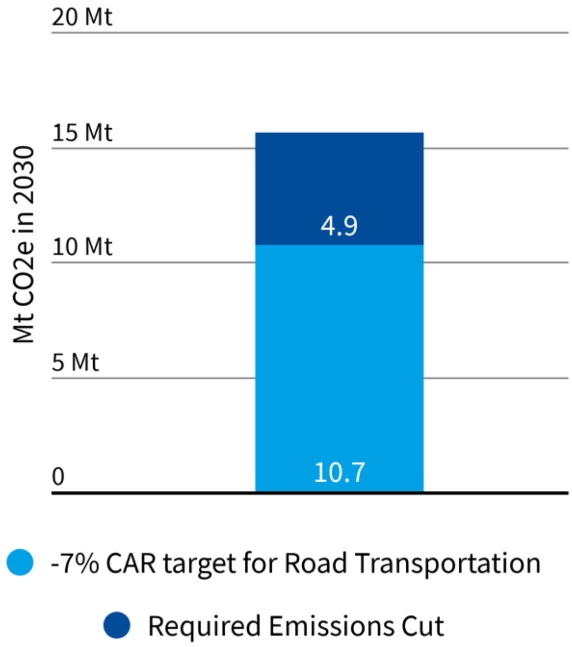

Figure 5: Baseline projection of road transport emissions in Hungary will reach 15.6 Mt CO_2e, compared to the CAR reduction target of 10.7 Mt CO_2e. Hungary must reduce its projected 2030 road transport emissions by 4.9 Mt CO_2e.

Given the above assumptions of the contribution that should be made by the transport sector, Hungary will exceed its target by 4.9 Mt when looking at transport only. If the cost of CO_2 allowances were to be €100/tonne, this would translate to €490 million in 2030 alone. However, the actual loss will be far greater, because of the aforementioned yearly targets. With the starting point assumed to be at May 2019, the cumulative allowances (tonnes of CO_2) that Hungary would be liable to pay for would amount to 30 million (without the use of flexibilities or safety reserve). At the assumed price of €100/tonne, this equates to a sum or €3 billion in the period 2020-2030, an amount only from the transport sector, unless other CAR sectors would decrease their emissions considerably to compensate. If the EU and Hungary were not to take any action on GHG emission mitigation, consequences to the environment aside, this could result in a significant financial burden for Hungary and would require a reduction in emissions of 0.8 Mt CO_2e per year in transport to decarbonise the sector by 2050.

3. How the EU can help

It was shown that road transport was the biggest sector of CAR emissions. Figure 6 further breaks road transport down into its constituent parts. As can be seen, the largest share of emissions in 2016 was from passenger cars, followed by those from heavy duty trucks and buses[3]. In this section, the specific EU mechanisms to ratchet up climate ambition in transport will be explored. Firstly, a look at the current proposals (under negotiation) and how much they can help Hungary reduce their emissions. Secondly, more ambitious targets based on technical and economic analysis will be explored to see what EU CO_2 vehicle standards *should be*. Note: In this report, the emissions from motorbikes are not considered for measures to reduce emissions or in the calculation of targets and trajectories.

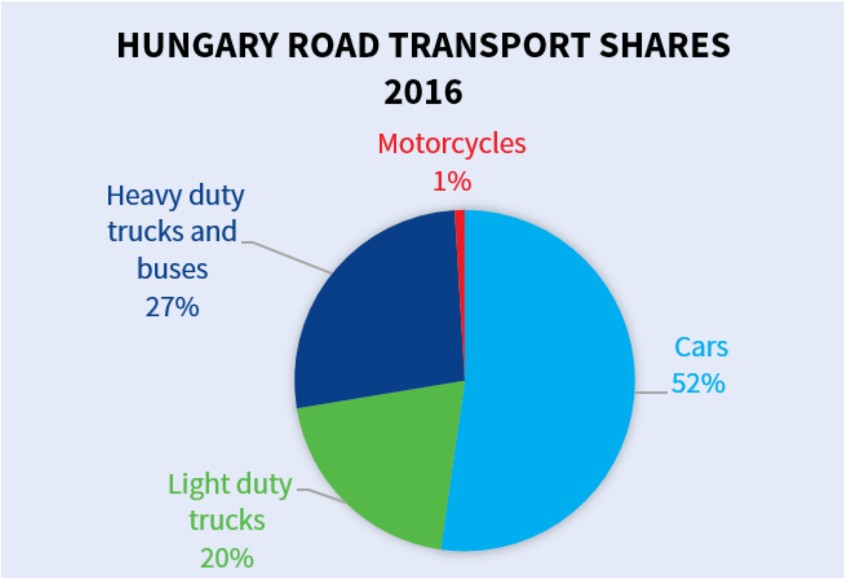

Figure 6: Road transport CO_2e emission split by mode in Hungary 2016[lxxvii].

3.1. Proposed EU measures for transport

In November 2017, the European Commission released a proposal for car and van CO_2 standards for 2025 and 2030. The proposed reductions for the fleet average of new cars are 15% in 2025 and 30% in 2030 compared to 2021. Although there was no zero emission vehicle (ZEV) mandate in the proposal, a bonus system is included whereby car manufacturers are able to reduce their fleet-wide CO_2 targets if they sell more zero and low emission vehicles than the sales benchmark proposed (15% sales in 2025 and 30% in 2030). For example, if 16% of sales were zero and low emission vehicles (ZLEVs), the CO_2 standards could be reduced by 1 percentage point, making the target easier to reach[lxxviii]. The bonus is capped at a 5 percentage point reduction. There is however no malus or penalty if a manufacturer sells less ZLEVs than the benchmark. The proposed van standards are also 15% reduction in 2025 and 30% reduction by 2030 (with baseline year of 2020) with the ZLEV bonus system. Unlike the 2020 and 2021 targets that were given in gCO_2/km, the percentage reduction allows for the change to the new driving test cycle (WLTP) from the existing one (NEDC).

In May 2018, the Commission proposed truck fuel efficiency standards. The truck standards do not include CO_2 improvements from modifications to the trailer (for example from better aerodynamics), only the tractor. Furthermore, the truck standards apply to only a select subgroup of trucks ('regulated categories', 4, 5, 9,10) which cover approximately 80% of truck emissions in terms of CO_2 emissions per year and

[3] The UNFCCC category *1.A.3.b.ii. light duty trucks* are mostly vans, i.e. light duty vehicles used to carry up to 8 passengers or with a maximum permissible mass of 3.5 tonnes, including load.

historical sales (Figure 7[4]). Under the proposal which, like for cars and vans, is currently being debated, these regulated truck sales must reduce their emissions by 15% in 2025 and at least 30% in 2030 (the latter to be revised by 2022), compared to 2019. Similar to the cars and vans draft, no ZEV mandate is proposed but rather a somewhat weak system of super credits, a point which will be discussed further on in the report.

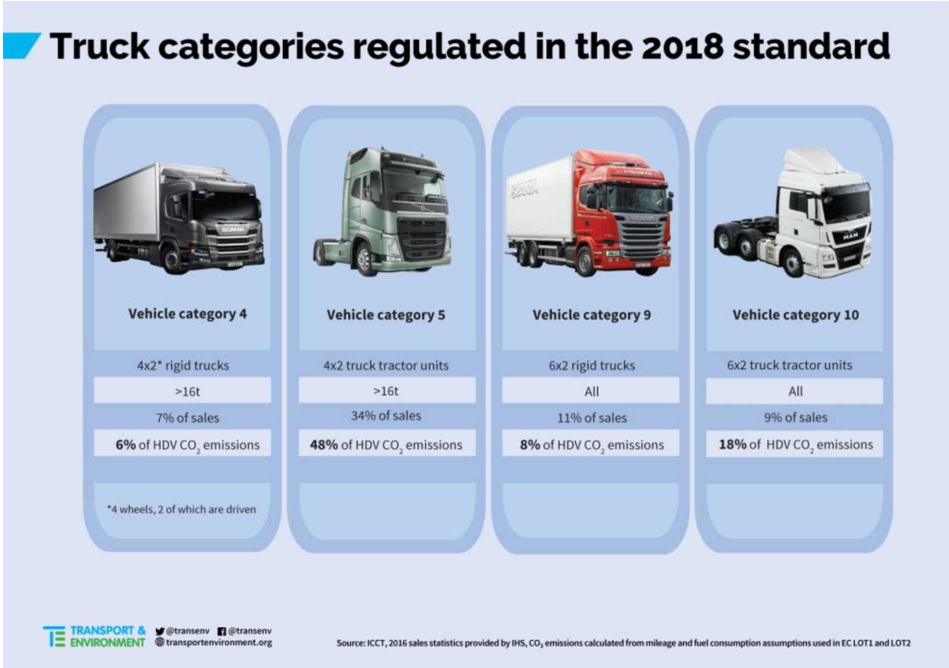

Figure 7**: Regulated trucks in the Commission's truck CO_2** standards proposal

If vehicle makers meet the Commission's proposals, but don't exceed them, it will deliver 19% of the required cuts for all of road transport in Hungary, or 0.9 Mt of the required 4.9 Mt CO_2e (see Figure 8). The reduction in emissions does not equal the reduction in new fleet vehicle efficiency owing to the time taken for fleet renewal. The Hungarian vehicle fleet is on average older than in the EU average, which means that older, more polluting vehicles tend to remain in the fleet longer than for other Western European countries (in comparison to other Eastern European countries, however, Hungary's vehicle fleet in not so old). Therefore, in the situation that only the proposed CO_2 standards for road vehicles were to be implemented, Hungary would have to come up with a range of national measures to be able to cut the remaining 4 Mt of emissions. Clearly, more has to be done and can be done, at the EU level simultaneously with national measures.

[4] Sources for Figure 7: ICCT, 2016 sales statistics provided by IHS Markit, CO_2 emissions calculated from mileage and fuel consumption assumptions used in "Reduction and Testing of Greenhouse Gas Emissions from Heavy Duty Vehicles" (LOT1, Ricardo-AEA Ltd, 2011; LOT2, TU Graz, 2012)

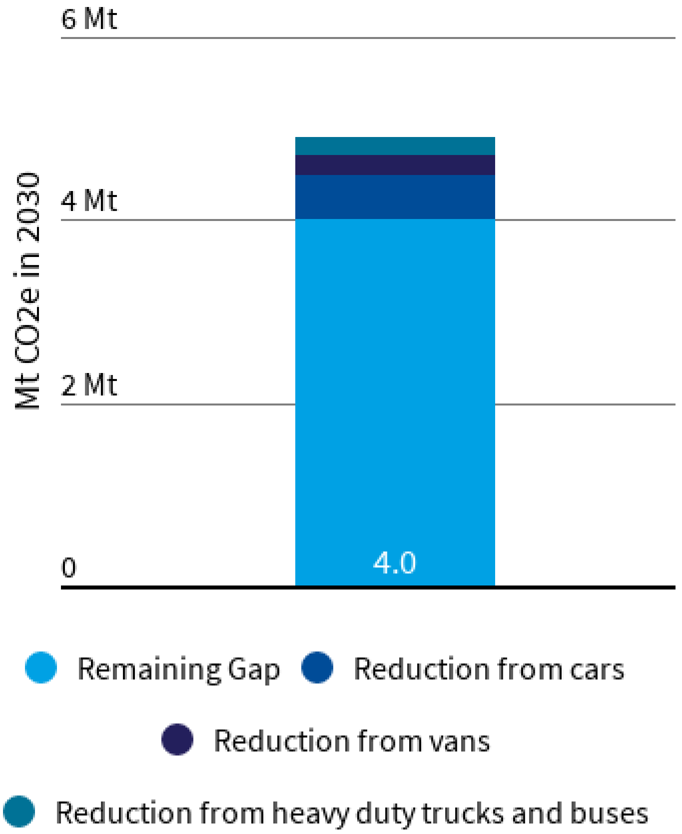

Figure 8: Reduction in Road transport emissions from Commission proposals on car, van, and truck fuel efficiency standards for 2030

3.2. What ambitious and feasible EU measures in Hungary can deliver

3.2.1. Ambitious and technically feasible fuel efficiency standards

CO_2 emissions of new cars can feasibly be reduced by over 50% by 2030 as shown by International Council on Clean Transportation (ICCT)[lxxix]. This is also more in line with the ambition levels necessary for transport to deliver the Paris Agreement goals. Van CO_2 standards were shown to be optimum in the Commission impact assessment[lxxx] at a 40% reduction, by comparing the required investment in technology from the OEMs and the fuel savings that would generate for consumers – typically businesses and tradespeople. As regards ZEV vans, there is a clear lack of models and choice on EU market[lxxxi], which the bespoke ZEV sales target for new vans in 2025 and 2030 is indispensable to address.

The truck fuel efficiency proposal should eventually include the trailers and non-regulated trucks. Owing to the large variety of trucks and their operations, fuel efficiency will be calculated with the simulation tool VECTO (Vehicle Energy Consumption Calculation Tool)[lxxxii]. This tool could be easily and feasibly modified to not only account for all categories of trucks, but their trailers as well. This will allow manufacturers to have a holistic approach to reducing the real world emissions of the truck. If this were the case, the ICCT shows that a 24% reduction (tractor unit only) is economically viable and technically feasible by 2025, increasing to a 45% reduction (with trailers included) in 2030[lxxxiii] compared to a 2015 fleet average truck. Trailers are not included in the 2025 reduction target, so the Commission proposal of a 2025 reduction of 15% for regulated trucks is assumed to remain. The "at least" 30% target for 2030, on the other hand will be reviewed and finalised no later than 2022. After trailers are regulated in the early 2020s, T&E expects that total reductions from tractor and trailer (where applicable) should average 45% compared to a 2015 baseline (or approximately a 43% reduction compared to the 2019 baseline). There is currently very little information on applying vehicles standards to coaches[5]. However, it seems reasonable to expect that the technology improvements leading to efficiency gains employed in trucks could be utilised in coaches. Therefore, we assume that the efficiency gains proposed by the Commission for trucks could feasibly be applied to coaches (i.e. a 15% by 2025; at least 30% in 2030, compared to 2019).

3.2.2. Zero emission vehicle sales targets and promotion

The other main mechanism available to Europe is a zero emissions vehicle (ZEV) sales target (also known as a benchmark or mandate). There are also complementary measures to promote electrification of the fleet, for example by accelerating standardisation and deployment of EU charging infrastructure. The renewable electricity share in transport (RES-T) target is also one such mechanism, however with a multiplier of 4 recently agreed on in the revision of the Renewable Energy Directive, this will not necessarily lead to a large uptake[6]. Finally, there are some modes, particularly vans[lxxxiv] and buses[lxxxv] where evidence suggests that electrified versions are already economically viable on a total cost basis; all that is missing is the supply from European OEMs[lxxxvi]. Importantly, an uptake in electrification should not allow OEMs to reduce ambition on internal combustion engines; selling an EV should not reduce the efficiency of the other vehicles.

For passenger cars, there remains a constrained supply and choice of plug-in vehicles (PHEVs and BEVs) in Europe; as carmakers in Europe are lacking a regulatory push to invest in sufficient capacity and increase sales[lxxxvii]. But an increased offering is expected in 2019/20 as carmakers have to meet their 2021 CO_2 targets. The complexity of PHEV dual drivetrain systems will eventually be too expensive to compete with BEVs in the context of rapidly falling battery prices and no investment required for pollutant suppression. A clear ZEV sales target (or mandate) would create volume certainty and ensure OEMs invest and offer sufficient supply of appropriate ZEV models in the future. The target of at least 20% sales in 2025 and over 40% in 2030 is in line with carmakers' own projections[lxxxviii]. This would spur the investment in OEM factories and supply chain (e.g. battery cells) in Europe, as well as recharging networks, and enable power companies to anticipate the future electricity demand that will help investment of clean renewable energy. Alongside a ZEV mandate for cars to stimulate supply, the best practices of other European countries as detailed by the ICCT[lxxxix]. These include tax exemptions, priority parking and priority lanes, and zero emission zones in cities (discussed in the national measures section) that help promote ZEVs on the one hand and restrict ICE vehicles on the other. Note that in this report, electric cars are assumed to be included in the CO_2 target itself.

Electric buses are a well proven technology, the salient example being Shenzhen in China where 100% of the city bus fleet (16 400 buses) were replaced with electric. In Europe, electric urban buses are gaining traction, according to an independent market monitoring and analysis orders for electric buses doubled in 2017 compared to 2016 reaching around 10% of the total European city bus market. New electric bus suppliers are emerging in Europe. The Hungarian manufacturer Evopro has been providing electric buses to cities like Budapest (20)[xc]. Other major European electric bus manufacturers include Solaris (Poland) and VDL (Netherlands). In Hungary, the electric bus fleet is around 58 battery electric (including trolley buses with batteries)[xci]. According to an industry survey by UITP data, 41% of city buses procured in the EU by 2025 will be zero emission, rising to 62% by 2030[xcii]. Joachim Drees, CEO of MAN Trucks and Buses, has proven to be more ambitious and expects that European cities will only procure electric buses from 2025 onward[xciii] while the proposal for the Revision of the Clean Vehicle Directive suggests that Hungarian cities will have to procure 42% "clean buses" by 2025 and 63% by 2030[xciv]. However, based on the favourable total cost of ownership compared to diesel and gas buses and the desire for municipalities to improve air quality

[5] We consider buses to fall under two broad categories: coaches, for intercity travel, and city buses; those that operate under a fixed timetable in metropolitan areas.

[6] When calculating the RES-T (i.e. quantity renewables / total fuel consumption), 'sustainable' biofuels and renewable electricity have a multiplier in the numerator (and liquid biofuels also have a multiplier in the denominator)

and reduce noise, it is unlikely that cities would procure expensive and polluting buses that rely on imported oil or gas after 2030[xcv]. Therefore, based on the above we assume 50% of new city buses purchased in Hungary will be zero emission from 2025 and 100% from 2030[7].

Small electric vans are already economically viable as shown by example of the success of the Street Scooter and independent studies[xcvi]. As small vans make up approximately 40% of total van sales, the main limitation is the number of models available. We assume BEV sales of vans (no PHEVs, owing to their expense and the price sensitivity of business operators) reach sales of 50% by 2030.

Finally, there has been an increasing number of battery electric trucks (BETs) in most weight categories in China, the US, and in Europe. They have been shown to have a favourable total cost of ownership (TCO) in many operations today[xcvii] or within the next decade[xcviii][xcix]. In Hungary, 33% of vehicle km and 31% of tkm are journeys less than 300 km, and more than half of road freight movements are less than 500 km[c]. These types of journeys could feasibly be covered by battery electric trucks with today's technology (in terms of battery energy density). Another technology that is currently undergoing significant testing and offers a pathway to electrifying road freight is the e-highway[ci]. This is charge-on-the-move technology, where trucks connect to overhead wires with a pantograph on arterial routes. Hybrid versions or on board battery storage can be used off the e-highway grid[cii]. This technology would require an EU wide coordinated and standardised roll-out to reap maximum benefit. According to the German Ministry of Environment, e-highways are the cheapest option to electrify heavy duty road transport[ciii]. Hungary would likely have to wait for implementation of e-highways on an EU roll out. Indirect forms of electrical power are more inefficient. Hydrogen and power-to-liquid technology require from 3 to 5 times more electrical energy than for direct use of electricity[civ]. Additionally, these e-fuels are much further from maturity and much more expensive, and this may hinder any significant market share before the late 2020s, too late to be deployed to achieve the 2030 climate goals.

As is the case for cars, a ZEV mandate spurs investment in new technology and will lead to a diverse option of trucks with electric drivetrains. We assume that a significant portion of these journeys will be electrified in BETs, with 20% of new truck sales <16t and 10% truck sales >16t being battery electric trucks by 2030. This is close to the TNO analysis[cv] under which 33% of new truck sales (in categories 4, 5, 9 and 10) must be zero emission in 2030 to meet the EU climate targets. The results of adding ZEV mandates for cars, vans and trucks and their promotion are shown in Figure 9. The Figure shows that ambitious standards and ensuring a minimum number of zero-emission truck and van sales in Hungary does 44% of the effort, leaving 2.8 Mt CO_2 of reductions still to achieve.

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[7] Urban v-kms from the model TREMOVE are used as a proxy for possible sales.

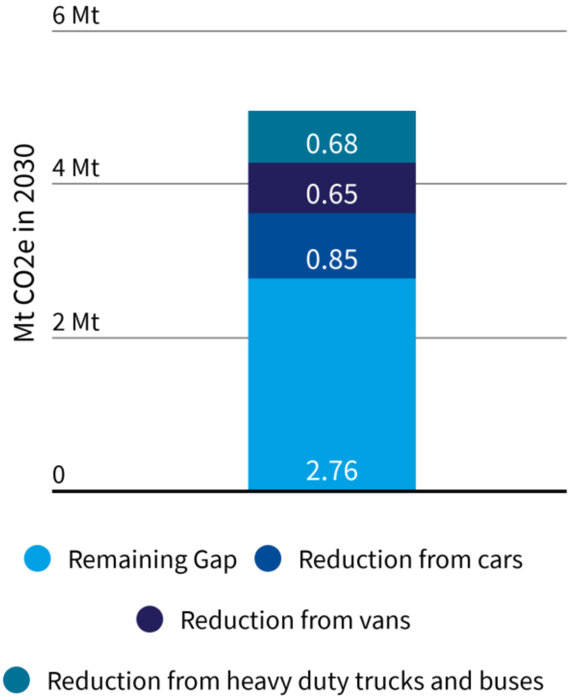

Figure 9: Combination of ambitious 2025 and 2030 standards, and ZEV mandates and promotion in Hungary.

3.2.3. Other EU measures

Other measures that fall under the jurisdiction of the EU include *Eurovignette*[8] (road charging for trucks) and the ongoing construction of the TEN-T network with harmonisation in the EU with respect to signalling (ETRMS) and rail gauge. These measures will indeed help with incentivising and facilitating modal shift, demand reduction, and logistic efficiency, however it will largely be up to each Member State to implement and lever these frameworks to maximise the benefits. These, among many more options, are described in the following section.

[8] Directive 2011/76/EU

4. What national measures are needed in Hungary to achieve the 2030 GHG reduction targets

4.1. What has been proposed or considered in Hungary

In this section, the various mechanisms available to Hungary will be discussed. Although some measures have quantifiable impacts, the effect of the full combination of measures that may partially overlap is difficult and arguably futile. Thus, each measure is discussed and analysed and a thorough assessment given as to how the measures may reduce GHG emissions. All inputs into the model are summarised towards the end of the section.

4.1.1. Fuel taxes and tax reform

Figure 10 shows that, in real terms, the excise duty applied to fuel in Hungary has been decreasing since 2005[9] from a sales weighted average of about €0.58/l to €0.38/l in 2017. This compares to the EU average in 2016 at €0.53/l. As is the case in the EU, there is a difference between the taxation of petrol and diesel, which over time has been reducing. In 2017, the Hungarian state earned €1.9 billion from fuel duty; had the diesel duty been the same as the petrol duty, revenues would have been €2.0 billion, or 5% more, all else being equal. Similarly, if Hungarian taxes were not only equalised but also €0.15/l higher to be in line with the current EU average, revenues would be €2.7 billion, or 42% more than they were. As the price of fuel paid at the pump is not just excise duty, but the price of fuel itself (including refining, distribution, and profit) and VAT, the relative increase paid at the pump would be around 13% for petrol and 15% for diesel.

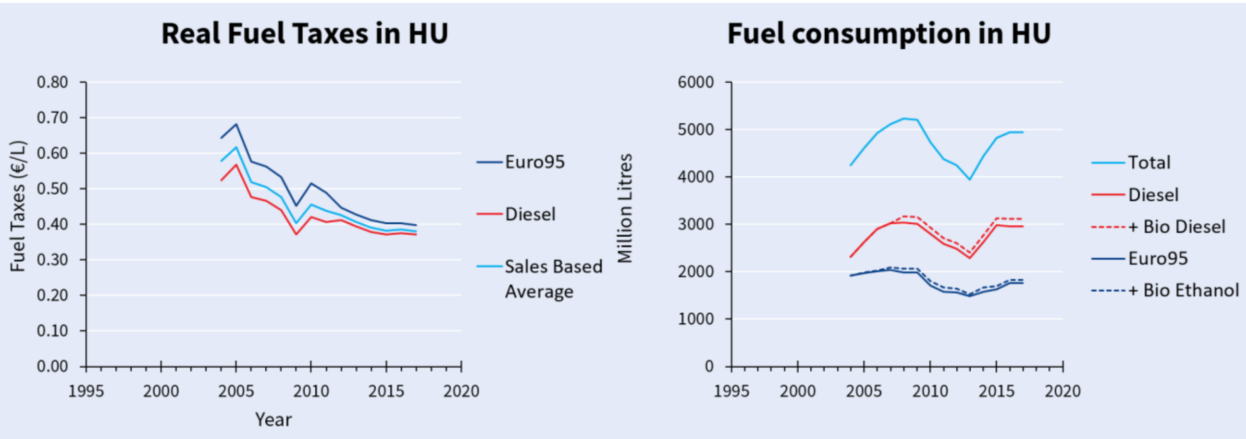

Figure 10: Evolution of fuel taxes and fuel consumption in Hungary.

Vehicle Registration Tax applies to all passenger cars and motorcycles for use in Hungary. The tax, levied by customs authorities, is determined depending on the engine size, fuel type, and environmental classification and age of the vehicle[cvi]. The present environmental differentiation between environmental classes in itself would be sufficient to promote the purchase of more fuel efficient and less polluting cars. However, this effect is practically nullified by the fact that the older the car, the lower the registration tax, and this is an important incentive to import older, more polluting cars. This cannot be changed due to EU rules.

Company car tax in Hungary is relatively low and once the tax has been paid, the car can be used, without restrictions, for private purposes; if a car owned by a private person is used for business purposes, then all the fuel costs plus an allowance of HUF 15 (about EUR 0.05) per kilometre can be paid out free of taxes. In 2017, this earned Hungary the 'Dirty Tax Gift Award 2017' from Climate Action Network Europe[cvii].

[9] T&E analysis on the Fuel bulletin database and Eurostat data.

Fuel taxation (or, alternatively, road charging) is not only a means to earn money for the state, it helps internalise the externalities of transport (societal costs of infrastructure, congestion, health problems related to pollution, injuries and loss of life due to accidents) and more significantly, it influences the long term behaviour and choices of passengers and freight operators. One study[cviii] has investigated the price elasticity[10] demand for fuel in Europe, the result for Hungary giving long term elasticities for petrol of -0.128 and diesel of -1.0. If we take a middle ground of these estimates and assume a long term elasticity of -0.56 for car use, to take an example, the decrease in ICE vehicle activity based on the implementation of tax harmonisation with the EU level would be around 8% while demand in EVs would remain unchanged. However, it may have other effects too, such as increasing carpooling or modal shift to bus or train. In terms of the change in freight movements, this could lead to a preference of more efficient vehicles (which would only become increasingly available with the implementation of European CO_2 standards for trucks) and an improvement in logistics efficiency. According to Ricardo, the EU average elasticity for trucks and vans is -0.3[cix]. These types of measures would reduce the transport activity of road modes, and with appropriate policy can enable cleaner modes such as rail to increase their share of transport.

4.1.2. Facilitate and encourage electromobility

Which vehicles carmakers place on the market across EU countries, or supply, in the EU is governed by the car and van CO_2 standards. Including the ZEV sales target into the 2025 standards currently under discussion as described under EU measures will help Hungary to have a bigger offer of ZEV models as well as make them more affordable due to economies of scale. But this cannot and should not occur in a policy vacuum in the Member States. Hungary has shown little ambition on electro-mobility in their national plan for the deployment of alternative fuels infrastructure (under the Directive 2014/94/EU)[cx]. Currently about 1 600 electric vehicles are on the road in Hungary[cxi] while the 2020 target ranges between is 12 000 and 54 000 EVs (middle scenario is 21 000 EVs). The middle scenario plans for 2 100 public charging points in 2020 and 18 100 by 2030. Today, Hungary has about 270 public charging points. Hungary is lagging behind its envisaged plans in the alternative fuels infrastructure development, set forth in the National Framework Policy for Alternative Fuels. Considering the current state of the market and even expected developments in the near term, the low penetration scenario appears to be the realistic one to be achieved (1 265 charging points in 2020 and 5 900 in 2030). Ambitious measures and financial support are needed to provide certainty for market actors if Hungary doesn't want to be in the lower bound of its own targets. Hungary currently has registration, ownership and company tax benefits for EV purchase. In addition, the government supports the purchase of an electric car by 21% of the price (up to 1.5 million HUF), however, the total sum allocated (HUF 2 billion) for this purpose is enough for only about 1 500 cars[cxii]. In October 2018, the government announced continuation of the program with HUF 3 billion more[cxiii]. Furthermore, the government decided to purchase about 1000 electric cars.[cxiv] The government is also creating a modern test track for vehicles in Zalaegerszeg where electric and self-driving cars can be tested and developed[cxv]. And across Budapest, electric cars can park for free.

Unfortunately, the Hungarian National Policy Framework focuses on natural gas (CNG) as a desirable alternative fuel, for which the estimated number of vehicles for 2020 is higher than for EVs in almost every situation (for 2020, 2025, and 2030 and for all three different levels of ambition). According to an analysis done by the electro-mobility platform[cxvi], Hungary is the only country with Italy and Czech Republic to clearly prioritise gas over electro-mobility. This poses many risks to the cross-border continuity of Europe's roads and jeopardises the transition towards a low-carbon economy and away from dependence on foreign fossil fuel imports.

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[10] Elasticity is the measure of how one variable (here, car use) changes with another variable (here, fuel price). In the most general case, as a something becomes more expensive, demand for it reduces. For the case described here, increasing the fuel price by 30% with the elasticity of -0.56 results in a change in demand of 30% x -0.56 = -17%, that is a 17% reduction.

4.1.3. Road charging and low emission zones

Budapest is the 41st most congested large city (population > 800 000) in Europe, with average travelling times increasing by 22% during times of congestion[cxvii]. While this is relatively low compared to other European cities, air pollution in Budapest is relatively high. In 2017, Budapest experienced an annual mean of 25 micrograms of particulate matter (PM) 2.5 per cubic metre (25µg/m³); by way of comparison, Paris experienced an average of 18µg/m³, Rybnik in Poland reached 40µg/m³, Tuzla, Bosnia & Herzegovina averaged at 65µg/m³, Prague, Czech Republic averaged 19µg/m³, and Bucharest, Romania averaged 23µg/m³ (the WHO recommends 10µg/m³)[cxviii]. Smart tolling could help tackling this. Tolls can be used to reduce congestion and to create zero emission zones. Cars spend a lot of time in cities, but a disproportionate amount of that time is spent parked. A distance and duration based charging system, whereby users pay per kilometres driven and hours of parking, can reduce the amount of cars in cities. Such a system encourages collective mobility (i.e. public transport, car-sharing, or carpooling) and allows for more space to become available for better cycling/walking infrastructure or parks.

In Budapest there is a system in place to restrict access to the city by trucks; there are 11 protected zones and 15 restricted zones in Budapest where restricted zones require heavy duty vehicles over 3.5 tonnes to have an entry permit for which a fee has to be paid[cxix]. The cost of access permits is based on the truck's total weight and vehicle emissions, and from 2016 all trucks with a weight of 3.5 tonnes being EURO 0 or EURO I were excluded from the permit list[cxx]. This is a good step towards improving the city's air quality and reducing congestion. To further tackle congestion and pollution, Budapest should consider introducing restrictions to passenger cars based on their Euro class; while the government has announced its support for Low Emission Zones (LEZ)[cxxi], none have so far been implemented. This would promote the use of cleaner vehicles and reduce emissions. Overall, Hungary has an older vehicle fleet compared to the rest of the EU with passenger cars averaging 14.1 years and medium and heavy vehicles averaging 12.7 years [cxxii] (compared to an EU average of 11 years and 12 years, respectively)[cxxiii]. As such, incentives for the uptake of newer, cleaner vehicles could go a long way to reducing emissions level in cities. Restrictive systems such as this in Budapest (with improvements to restrict cars as well as HDV based on both weight and emissions) should be considered for implementation in cities more widely across Hungary.

At EU level, in the short run, a 75% toll discount for all zero emission trucks across Europe would provide a financial incentive to encourage the purchase of zero emission trucks, which would help create a bigger market for zero emission vehicles. Hungary should be an advocate for this. In the long run, infrastructure cost should be paid fully by all users, and there should be a separate part of the toll depending on the vehicle's emissions.

4.1.4. Shifting car passengers to buses, trains, riding, and walking

Shifting passengers from cars to buses and trains can be divided into two broad categories, intercity and metropolitan. That roughly 70% of passenger train transport is concentrated in the agglomeration of Budapest helps explain the preference of expenditure in this area over others[cxxiv]. By 2015, 39% of the Hungarian railway network was electrified, slightly higher than Romania (37.42%), but lower than surrounding Slovakia (43.77%), Slovenia (41.36%), and much lower than Austria (71.24%)[cxxv]. Between 1990 and 2016, rail passengers on Hungarian trains decreased from 11.4 billion pkm to 7.7 billion pkm, although the last 6 years have been more or less constant[cxxvi]. The existence of rail in itself does not induce passengers to use it, however. Train schedules must be reliable, pricing fair and competitive with other modes, punctual services, and finally, modern and well-maintained rolling stock that can offer services such as wifi and clean toilets. Long distance coach journeys have also seen a rapid expansion in Europe with competition and market liberalisation[cxxvii]. Companies like Flixbus have expanded rapidly offering regular services that are reliable, easy to book, and cheap[cxxviii]. Coaches do not only compete with car transport; they can offer cheaper services than rail owing to their comparatively low costs such as infrastructure costs (as there are paid mostly by car and truck owners) and vehicle costs compared to rail. Coaches should therefore not be granted discounts to road charging or exemptions to any future vehicles standards to ensure that they both do not too heavily undercut rail but also pay their fair share of infrastructure and societal costs (CO_2, pollutant, and noise emissions).

In cities, in order to shift car passengers to public transport, an essential component is appropriate infrastructure for walking and cycling. While a journey by car is typically characterised by door to door transport, a public transport journey is often part of a multimodal trip, and may involve walking or cycling to a bus stop, a bus trip to the metro station, a metro trip, and then a walk to reach the final destination from the metro station. Although walking in itself will not be able to offer the same transport service as cars for relatively longer distances, it is an integral element of facilitating the journey. Cycling enables short distance trips to be largely replaced, especially with the generalization of electric bikes, making cycling a transport solution for more people. The most successful cities and countries (such as the Netherlands and Copenhagen) have high cycling rates owing to extensive infrastructure that is separate from the road and gives cyclists priority over cars. Between 2010 and 2015, Hungary's bicycle network increased by almost 50% from 2 058 km to 3 072 km[cxxix]. However, only a handful of Hungarian cities have bike sharing programs in use. The MOL BuBi system was introduced in Budapest in 2014 and has since expanded its network to 124 docking stations and 1,486 bicycles. Following a steady decline in use, and with support from the EU EMPOWER project, the Budapesti Közlekedési Központ (BKK; Centre for Budapest Transport) organised the Budapest Cycling Challenge and introduced rewards (such as club memberships, bikes and MOL Bubi yearly passes) to encourage participation and wider increased cycling[cxxx]. One university in the north east of the country introduced their own bike sharing scheme for staff and students to travel between campuses. The University of Debrecen introduced the bike sharing scheme UniBike in 2016 following demand by students; the scheme has 34 bikes and 4 docking stations, and was funded by the students union[cxxxi]. In Budapest and Eger, a non-profit organisation, BIKESURF, offers users a range of different bike models to hire in exchange for a donation (of time or money)[cxxxii]. June this year saw the launch of an e-scooter sharing system in Budapest with the partnership of Polish company Blinkee and E.ON[cxxxiii]. Over 2,000 people are already registered to the free-flow system, with the company aiming in future to expand to other major cities in Hungary.

Alongside cycling and walking, the public transport itself must also be reliable and affordable. Hungary is one of the last countries in Europe to introduce an electronic ticket system across its public transport network, and delays continue to affect implementation. A change in legislation in 2016 has delayed implementation of the RIGO system, to be used in all public transport vehicles under BKK, to 2019 at the earliest[cxxxiv]. On top of this, a number of barriers to the increased use of public transport remain, the largest of these is a lack of unified timetables and tariffs of the various transport companies. For instance, tickets cannot be transferred across transport modes (from bus to tram, for example; though this will be possible with the implementation of electronic tickets). Nevertheless, important measures have been taken over the years to provide priority for public transport vehicles in traffic, these include the implementation of priority bus lanes[cxxxv] and the adjustment of a number of traffic lights to provide priority to trams[cxxxvi].

While the number of passenger cars in Hungary is relatively low (338 passenger cars per 1000 inhabitants) in comparison to the EU average (505 passenger cars per 1000 inhabitants)[cxxxvii], shifting passengers from cars to public transport is vital to achieving Hungary's climate targets. In 2016, the Hungary-wide modal split of passenger transport in terms of passenger kilometres (not by trips made) was 66.5% by car, 20.9% by bus and coach, 9% by rail, and 3.6% by tram and metro. Considering car transport was 56.7 billion pkm, shifting 10% of this activity to public transport would imply a 17% increase in public transport vehicle-km which might be feasible even with the present public transport vehicle stock. Further shift would already require additional investments in public transport; calculations for such a shift were made in 2006 for Budapest and surroundings (the study[cxxxviii] was commissioned by the ministry responsible for transport). Hungary will need to see continued and increased investment and policy choices to achieve this increase and to build on it even further.

4.1.5. Putting more passengers in each car and sharing resources

The transport system is on the verge of a paradigm shift from the tradition of private car ownership to models around sharing and mobility as a service (MaaS). This has largely been through a revolution in digitalisation and application based services (e.g. Blablacar, Uber), and business models that facilitate car and charging infrastructure sharing (e.g. GreenGo and MOL Limo in Budapest). In 2016, Uber suspended its services indefinitely after the Hungarian government introduced a law effectively banning the service provider from operating. Following Uber's exit and that of similar ride-sharing apps, the share in taxi rides increased by 50-60%, according to Hungarian taxi firm 'City Taxi'[cxxxix]. Car-sharing, on the other hand, currently operates in Budapest through three companies: GreenGo[cxl] and MOL Limo[cxli], which are both free-flow services with only and partly electric cars, respectively, and Avalon[cxlii] , which uses fixed stations and a wide range of various cars and vans. Altogether, there are more than 500 car-sharing cars. Similarly, carpooling has dramatically increased over the last 10 years. The most popular carpooling website, Oszkar, has more than 600,000 people registered[cxliii], and several other websites exist.

Evidence[cxliv] shows that these developments can lead to a significant reduction of single occupancy private car use and an increase of public transport use, leading to a strong reduction in congestion, local air pollution, and CO_2 emissions[cxlv] [cxlvi]. The French environment and energy management agency (ADEME) found that each shared car replaces in average 5 to 6 private vehicles, while freeing up at least 2 parking places.[cxlvii] These benefits will occur when more vehicles are shared and private car ownership is reduced; when these shared vehicles are electric, the benefits are even greater. Modelling by the International Transport Forum found that in Lisbon replacing all private cars with car sharing and car-pooling services could make transport much more efficient, substantially reduce traffic emissions, and greatly decrease required parking space[cxlviii]. This study as well as a survey by the Pew research centre[cxlix] and work by the Union Internationale des Transports Publics (UITP)[cl] indicate that car and ride sharing complement public transport, but do not replace it. As citizens abandon their own cars and opt for shared resources, more active forms of transport (walking and cycling) become attractive, space is liberated for appropriate footpaths and cycling paths. The technology behind these applications can enable more passengers per car, as pooling services are enabled. This can be reinforced with favourable conditions for cars with multiple (more than 2) occupants on key city roads. While the development of shared mobility seems unstoppable, whether the transition from ownership models to sharing will lead to short term increase in congestion because of induced demand will largely vary from city to city, depending to a large extent on the policies of the local municipality and the national governments.[cli]

4.1.6. Eco-driving, speed limit reduction, communicating intelligent transport systems (C-ITS), and connected vehicles

Eco-driving is a program for drivers that can reduce CO_2 emissions from cars, vans, trucks and buses by training drivers to reduce speeds, anticipate traffic situations to maintain more constant speeds, and reduce the severity of accelerations or braking. One source with authors from the industry[clii] has shown that the benefits of eco-driving is highly dependent on how many eco-drivers there are and the level of congestion. It showed that in congested roads, eco-driving has a maximum benefit of 4% if all drivers adopted and use eco-driving practices, while in free flowing traffic, the benefit ranges from a 4% benefit, if 25% of drivers employ eco-driving, up to 15% in the ambitious scenario of all drivers employ eco-driving. Other studies from car manufacturers showed that eco-driving could bring a potential saving[cliii]. However, the JRC[cliv] and others[clv] found that the impacts of eco-driving tends to decrease over time. This implies that the benefits would require extensive and repetitive training programs of all drivers to see appreciable benefit. Although this may be feasible for professional drivers where the burden may fall on transport companies, such a broad program for all drivers is unlikely. The EU and national governments should promote the development and use of IT systems that assist drivers to drive in an environmentally less harmful way.

Reducing speed can have a significant impact on CO_2 emissions, particularly at highway speeds, as aerodynamic drag increases proportionally to the square of a vehicle's speed. With full compliance of speed limits, the EEA reports that modern cars could reduce their CO_2 emissions per kilometre by up to 12% (in line with findings from Ricardo[clvi]), but in a more realistic scenario, it would more likely be 3%[clvii]. Imposing lower speed limits has precedents in the EU (in France[clviii] and Belgium[clix], for example). In Hungary, a national urban speed limit of 50 km/h is in place, while rural areas are only limited to 90 km/h, and motorways to 130 km/h (enforcement is ranked high, however)[clx]. Reducing speed limits in cities improve pedestrian and cyclist safety with less severe injuries and smaller probability of fatalities[clxi] (there will also be CO_2 savings due to substantial decrease in accelerations, but these savings will generally not be particularly high). Hungary reported 591 road traffic fatalities in 2013 (the WHO puts that figure at 765), with 25% of those deaths being pedestrians and another 11% cyclists. The WHO suggests that reducing average speed by 5% can result in a cut in the number of fatal crashes by 30%, and moreover, states that when combining motorised traffic with pedestrians and cyclists, the speed limit should be under 30 km/h[clxii].

In addition to pricing pressure, technology can play a role in making transport more efficient. The flow of real time information regarding cargo space and arrival time is underutilised in road haulage. Internet applications are being developed and increasingly used, enabling road haulage companies to be more aware of goods available to be transported near their trucks. These tools can help to eradicate dead mileage and reduce empty legs. Increasing the cost of road transport will increase the uptake of such technologies as road is currently too cheap for this technology to be adopted at the extent necessary to have an impact on logistic efficiency.

Both Ricardo 2016[clxiii] and the European Commission[clxiv] state that widespread and rapid deployment of C-ITS can reduce the fleet emissions from cars by 1.0%, buses by 1.7%, vans by 0.8%, and 0.7% for trucks. The maximum potential for each mode does not exceed 4.5% (for buses) in 2050, which gives an indication of improvements to new vehicles.

In 2014, the BKK Centre for Budapest Transport launched an online journey planner application, app[clxv] as a part of the so-called FUTÁR public transport managing system. The app gives details of public transport schedules and stops, as well as real time positioning of vehicles.

4.1.7. Shifting freight from trucks to trains

In Europe, around three-quarters of freight is transported by road[clxvi]. Modal shift has long been lauded and promoted as a key driver to decarbonize freight transport. The railway network in Europe is largely electric and far more energy efficient than today's truck transport[clxvii]. In 2011, 86% of train-km for freight were performed on electric traction in the EU. However, only 60% of freight railway total energy consumption is performed by electric traction. In 2016, railways transported 18% of freight in Europe in terms of tkm. Hungary is well above the EU average, at 28.5% and 10.5 billion tkm.

In the EU, 50% of rail freight is international, and this is also the case in Hungary. The share of transit undertakings is the second highest in Europe, at 34.7% of tkms. Clearly, the priorities of the TEN-T network to enable smoother international freight, particularly to and via Austria to other large EU Member States is vital for rail freights viability. As trucks from abroad paid 51.2% of the road toll on Hungary's motorways[clxviii], interoperability between international railways is essential in order to shift freight from road to rail. Moreover, Hungary lies at the intersection of four of the ten pan-European transport corridors, which should enable the logistics industry to develop hub functions for regional and international freight flows[clxix]. However, attaining this potential is not at all simple, as described in greater detail by the Rail Freight platform coordinated by T&E[clxx].

Indeed, rail freight faces a number of barriers to its expansion. The largest of these is a highly and unfairly competitive road transport system; namely, this competitiveness is largely due to the fact – mentioned above – that road freight does not pay a significant part of the costs it causes. The European Court of Auditors notes in particular that the expansion of the road toll charge for heavy duty vehicles in Germany (combined with a relatively independent regulatory body and strong industry) explains the comparatively high share of rail freight in this country[clxxi].

Under Connecting Europe Facility (CEF) funding, as of 31 July 2018, 38 Hungarian transport projects have received €1.1 billion of CEF funding of a total investment of €1.3 billion; railway received €860 million for 11 projects (compared to €132 million for 9 road projects)[11]. Given the above conditions, high expenditure on rail infrastructure alone will yield limited results in shifting freight from road to rail, as road will invariably remain the cheaper means of transport. Another barrier is lack of competition. Two infrastructure managers control the railways in Hungary: the MÁV Hungarian State Railways (MÁV Co.) (which manages roughly 7 200 km of the 7 700 km network) and GySEV (a Hungarian-Austrian private enterprise). In addition, a large number of speed restrictions are in place due to the ageing tracks[clxxii].

Rail is highly dependent on the type of goods being transported in the country. As shown in Figure 11 Hungarian rail transports a diverse mix of goods, with bulk commodities and general goods taking the largest shares. In the context of decarbonising energy, the amount of fossil fuel used in transport will need to decline to zero. On the one hand, this may open up more slots for other rail freight. Secondly, a distance of 300 km and below is where road transport is typically superior to rail in terms of flexibility and operational costs (i.e. infrastructure charges, loading costs, fuel taxes, driver costs, and capital costs for purchase of equipment). For rail freight to and from Budapest, this distance covers most of the country. The fact that Hungarian rail has such a high share in the modal split indicates that there are good international connections.

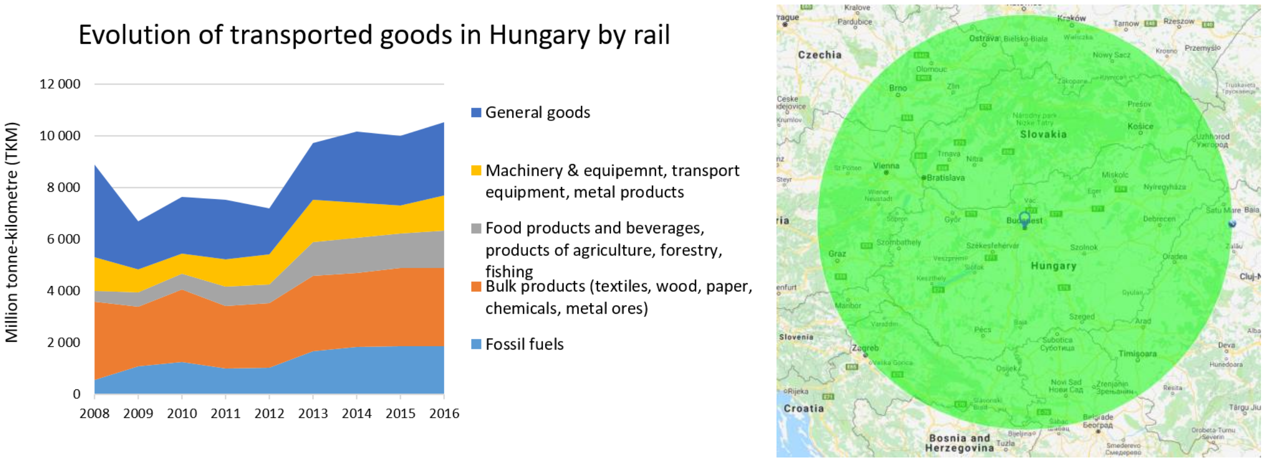

Figure 11: Evolution of freight carried by rail by type of goods carried and Hungary with a 300 km radius area centred on Budapest[clxxiii], overlaid.

Freight modal shift to rail is additionally discussed in the ECF interview with stakeholders[clxxiv] who identify barriers such as bottlenecks in the network, lack of electrification, tracks that bypass main urban areas, a competitive road transport sector, and the management of logistics terminals.

The National Transport Infrastructure Development Strategy briefly considers the necessity of an environmentally sustainable freight transport system, but contains no official targets for the growth of different freight modes. However, a number of companies have taken leadership to shift freight from road to rail independently. BorsodChem increased their share of rail transport from 0 to 70% within three years[clxxv], while last year Waberer's International (one of Europe's largest road freight transport companies) brought 400 trailers dedicated to rail transport[clxxvi].

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Furthermore, under the Integrated Transport Operational Program (2014 - 2020), the government plans to modernise the railway lines and extend the network by nearly 280 km[clxxvii]. Out of a total project cost of €3.9 billion, €3.3 billion will be funded under the EU Cohesion Fund and Regional Development Funds[clxxviii]. However, this Strategy also plans to extend the road network by 240 km to reach borders with other countries, thus adding to the competitive edge of the road freight sector.

Whatever potential growth that is possible for rail is unlikely to materialise without improvements in rail capability and greater customer service by rail freight operators. This shift in business model (i.e. a more customer-oriented and international vision) will come from a better environment for competition. This also is somewhat reliant on road charging, as the cost of road has to increase significantly so that the external costs of road transport (such as air pollution, GHG emissions and infrastructure costs) are internalised.

4.2. What national measures can deliver in Hungary

The previous sections described and quantified where possible the potential impacts of policy on transport demand, modal shift to cleaner transport, and policies to increase the efficiency of the transport system. These policies can have complex interactions and do not necessarily result in accumulative benefits. Therefore, these inputs are based on careful consideration of each measure so as not to overstate the potential of any given measure or combination of measures. On the other hand, these measures could be seen as targets that Hungary would need to achieve in order to meet its climate targets while designing policy. For example, to ensure car passengers are shifted to walking and cycling by the amount stated below, impact assessments should investigate how to achieve this, and what type of policy and investment is required to get there. In Table 1, the inputs to the model are detailed along with a brief justification and the policy levers required. Note that rebound effects of more efficient vehicles and lower fuel costs for electric vehicles (where reduced costs induce more demand), are not considered in this study, as the combination of other measures are assumed to be designed to negate this effect.

Table 2: Summary of inputs of Hungarian National level policies

Policy Lever	Reduction by 2030 (* 2025)	Measure	Main policy interactions and justification
1	2.00%	SHARE OF CAR ACTIVITY SHIFTED TO BUS (%)	New electric buses being able to offer cheaper services, urban road pricing for cars, coach market expansion. 2% of car passengers represent about 10% of current bus passengers, so this shift implies bus and coach passenger growth of 1% p.a. between 2020-30
2	10.00%	BUS LOAD FACTOR INCREASE (PASSENGERS/VEHICLE)	As more passengers are lured onto buses (policy lever 1), buses will tend to be filled, increasing efficiency. This will be supported by service improvements (that will follow from increased ridership), pricing, and multimodal ticketing.
3	2.00%	SHARE OF CAR ACTIVITY SHIFTED TO RAIL (%)	This represents a 2% increase of current tram, metro and train ridership. This will be facilitated by road pricing, TEN-T rail network implementation, intermodality, train pricing and improved punctuality, competition offering new and more attractive services.

4	2.00%	MODE SHIFT FROM CAR TO WALK/BIKE (%)	As part of a city infrastructure investment (foot and bike paths), urban road pricing and car load factor increase that reduce traffic and parking needs and thus space will be reclaimed space, and bike-sharing gaining popularity, more people willing to walk and bike.
5	15.00%	CAR LOAD FACTOR INCREASE (PASSENGERS/VEHICLE)	Car sharing, car-pooling, road pricing, higher vehicle registration tax, low emission zones, car ownership not a status symbol anymore (social justification)
6	8.00%	CAR ACTIVITY - REDUCTION FROM BASE CASE (%)	Combination of urban road pricing, low emission zones. Some of the reduction in demand has been through modal shift (policy levers 1,3,4)
7	5.00%*	FREIGHT TRUCK LOGISTICS IMPROVEMENTS (%)	Road charging, digitalisation and ending the rebate to truckers.
8	5.00%	SHARE OF HDV ACTIVITY SHIFTED TO RAIL (%)**	Combination of diverse measures required to enable rail freight to be more competitive. Trucks should be charged for their pollution and infrastructure damage through fuel taxes and road charging. Improved rail connections with Austria and Eastern EU countries with the TEN-T.
9	6.25%*	FREIGHT TRUCK PAYLOAD INCREASE (METRIC TONS/VEHICLE)	Distance and pollution based charging, digitalisation, city logistics.
10	5.00%	REDUCTION IN IN-USE FUEL CONSUMPTION OF ON-ROAD VEHICLES	C-ITS, eco-driving, congestion relief through charging, reduced and heavily enforced speed limits.

Figure 12 shows the result of applying only these national measures, without the EU measures on CO_2 standards and electrification. As standalone measures, they amount to about 3.2 Mt CO_2e reduction compared to the baseline. This illustrates that Hungary, and the rest of Europe, do benefit a great deal from EU measures such as CO_2 standards and electrification.

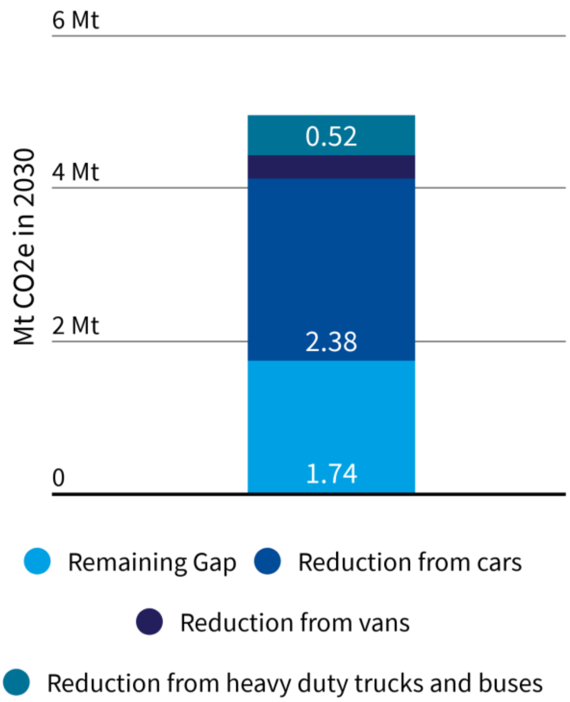

Figure 12: What national measures can deliver on their own in Hungary, without EU standards and EV sales targets.

Figure 13 shows the combination of ambitious standards, ZEV sales target, and national measures. The measures together can completely close the gap, and surpass it by 0.1 Mt CO_2. Although the measures described to reach this goal are ambitious, no measure goes beyond what independent research says is technically and economically feasible.

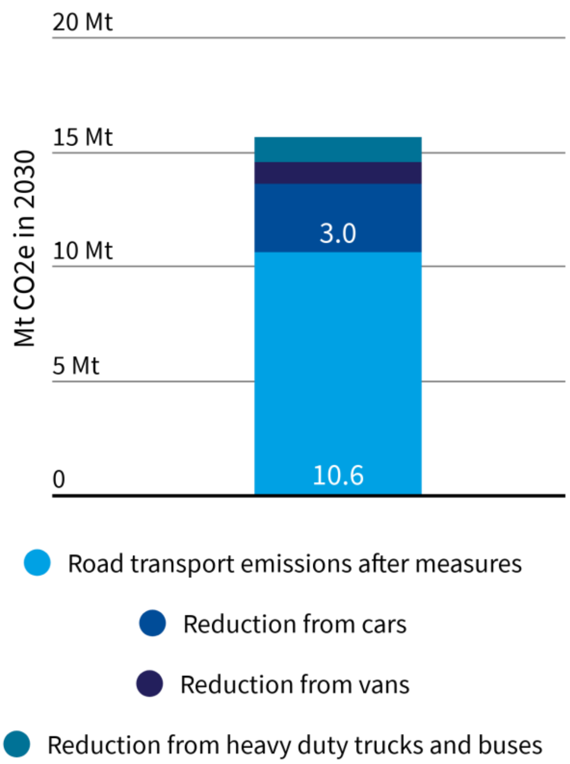

Figure 13: Combination of European and Hungarian measures to achieve 2030 targets.

5. Long term impacts of climate change mitigation policies in transport

Figure 14 shows the projections of the different scenarios discussed in this paper, until 2030. In all scenarios, the policies and consumer behaviour are again frozen in time, as was the case when defining the baseline for the modelling projections. This perspective shows the benefit in exceeding the 2030 target: in the scenario with all ambitious measures in place, the emissions can almost be extended with a straight line to zero emissions in 2050. What is sure is that beyond 2030, *even more effort* will be required to reach full decarbonisation by the mid-century, necessary to abide by the Paris Agreement. Full electrification of the vehicle fleet will be necessary, and the electricity grid in the meantime will need to phase out fossil fuel generation.

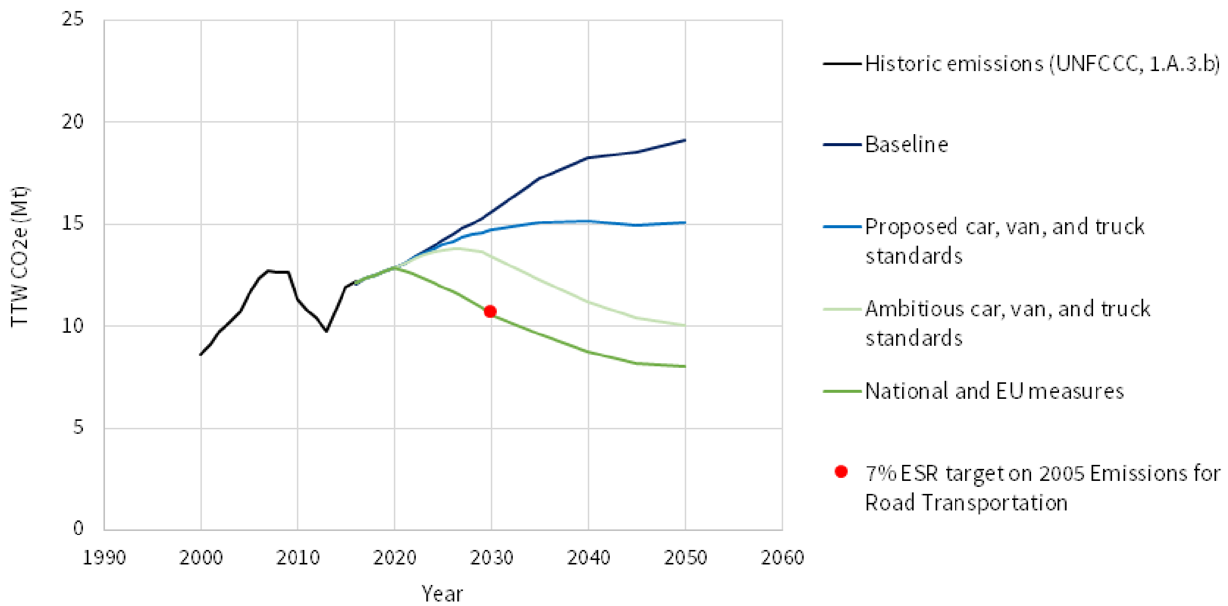

Figure 14: Long term trajectories of tank-to-wheel CO2 emissions in Hungary, compared to the 7% reduction target on 2005 levels. Results from the modelling.

5.1. Co-benefits

Reducing GHG emissions from transport is first and foremost a positive for the environment. As discussed in the opening paragraphs of these reports, Hungary is already experiencing climate change that is amplified compared to what is being observed in the rest of Europe. Environment aside, there are other compelling arguments to reduce fossil fuel use. Most of the EU's oil is imported, thus the energy security of the continent is dependent on unstable regions in the world and on top of this, and money is flowing out of the EU economy to these regions[clxxix].

Dependence on foreign oil will be reduced. The electric revolution can bring a lot of jobs in the EU - more jobs if we take the lead. This is particularly important in Hungary as it has 2.04% of its active employment ratio is directly employed in the automotive industry[clxxx], which could see its economy thrive with the right investments. Electric cars do not have emit pollutants, a huge benefit for air quality, health, reduction in noise pollution and liveable cities.

6. Policy recommendations

The following policy recommendations are based on the results of the modelling that show the required ambition of the various measures and the Hungary Report on the Decarbonisation of Transport prepared by Clean Air Action Group.[clxxxi]

This report has shown the potential of a wide range of European and Hungarian specific measures that can be met on technical and economically viable metrics based on independent research. The main barrier to their uptake would be a political one. With strong political ambition, Hungary can invest in future technologies that are beneficial for the society and the environment. In this section, we outline the key and concrete actions that Hungary can take to make it happen.

6.1. Vehicle standards

Cars and Vans

- The Hungarian government should support in the European Council an agreement without any delay for a binding and ambitious 2025 CO_2 standard for new cars and vans of at least 20% in 2025. This is the key policy that will reduce CO_2 emissions from cars and vans in the coming decade, as well as driving investments into zero emission vehicles and more fuel efficient petrol and diesel cars. The 2025 target is indispensable to help Hungary achieve its Climate Action Regulation goals in 2030.
- To ensure CO_2 reductions are achieved on the road and the current gap between laboratory results and the real-world decreases, a not-to-exceed limit should be set for all manufacturers in 2021. This limit should be verified using either a newly developed Real-world Driving Emissions test for CO_2 or the Fuel Consumption meters. The Hungarian government should support such an EU legislation.

Trucks

- The Hungarian government should support in the European Council an agreement without any delay for a binding and ambitious 2025 CO_2 standard for regulated trucks of at least 20% effective reductions in 2025. Similarly for light duty vehicles, this is the key policy that will reduce CO_2 emissions from trucks in the coming decade, as well as driving investments into zero emission vehicles.
- In the 2022 review, Hungary should push for trailers to be included in the regulation, along with ambitious standards for all truck categories. The efficiency improvement targets should be set as close as possible to the technical and economically feasible potential, which is 43% reduction for the tractor and trailer. For tractor trucks this means the 2030 target should be set at least 30% effective reductions. The trailer is currently not regulated, but there can be significant CO_2 savings from more aerodynamic trailers. For the tractor only, the economically viable efficiency improvements are therefore less.
- The Hungarian government should urge appropriate EU legislation ensuring the monitoring and reporting of carbon emissions and fuel consumption of trucks and buses. Transparent fuel consumption information enable public authorities and truck hauliers to make more informed choices based on total-cost of ownership and actual fuel consumption. ZEV mandate and promotion
-

Hungary should support the Commission in the creation of a joint undertaking for the research and development of battery technologies. Such a joint venture could be half funded by the EU budget and half funded by industry stakeholders. The EU could then use such a body to improve the European market for battery technologies while also researching how to reduce the environmental impact of the supply chain, as well as the best means to integrate electromobility into smart electricity grids. For Hungary, locally produced batteries could help the large car manufacturing industry there.

Cars and Vans

- As part of the EU CO_2 standards for cars and vans, the Hungarian government should urge EU legislation on separate sales target for zero emission vehicles that should be agreed for 2025 to drive the supply of electric cars in Europe. This can be done either via a dedicated ZEV mandate or by adding a malus to the currently proposed bonus system. This will spur innovation into electric powertrains and the supply chain in Europe, driving better offer and more affordable choice of clean cars. While plug-in hybrid cars should be included they should be rewarded less than zero emission vehicles such as battery cars, in line with their CO_2 emissions.

- Hungary should without delay finalise its National Policy Framework on the infrastructure for alternatively fuelled vehicles such as fully electric and plug-in cars. An ambitious target for the number of publicly accessible recharging infrastructure would speed up the sales and uptake of fully electric and plug-in cars while providing market certainty to electro-mobility players. This requires a joint approach to all levels of government to ensure infrastructure is rolled out rapidly and in the right locations, in a demand-driven way with innovative business models promoted.
- Sustainable and reliable support schemes and financial incentives to boost demand for fully electric and plug-in cars should be put in place. Notably, an appropriate road charging system should help the purchase and use of zero emission vehicles.
- Provide dedicated free parking space system with charging possibility for car-sharing e-cars, as lack of such parking spaces is one of the main obstacles to wider use of electric car-sharing.
- At the EU level, Hungary should support a bonus-malus tax system which in a revenue neutral way helps the purchase of zero emission cars.
- Hungary should substantially increase its renewable electricity production.

Trucks and buses

- Hungary should push for Europe to introduce a well-designed benchmark system with a bonus and a malus or a mandate for zero emission trucks of 5-10% by 2025 and 25-35% by 2030 and for buses of at least 50% by 2025 and 100% by 2030.
- Within the Weights & Dimensions Directive (96/53/EC), an additional one tonne of legally permissible weight for trucks up to 26 tonnes that are powered by “alternative fuels”, including electric powertrains is in force. This allowance does not apply to tractor trailer trucks, however. Hungary should push to change this law so that all trucks can benefit from additional tonnage to account for the alternative technology. As the batteries can range from 1t to 4t, Hungary may consider pushing for a small increase in gross vehicle weight (GVW) to accommodate these technologies so there is no or reduced penalty on the payload. The Commission is also expected to progress with the implementation of rules for rounder, more aerodynamic truck cabs during 2018. This will be a benefit to both battery electric trucks and to the new best in class ICEs.
- Cities across Europe have significant potential to push investment to electric trucks and to shift their urban buses fleet to zero emission. This bottom-up pressure from local governments and business will further incentivise vehicle makers to invest in zero emission trucks and buses, as a coalition of cities can constitute the majority of the population on the continent. The Hungarian government should support such initiatives.
- The Hungarian government should require 100% of newly publicly procured buses and trucks to be zero emission from 2030. This should be reflected in the review of the Clean Vehicles Directive.

6.2. Road charging

- Support a strong and efficient revision of the Eurovignette Directive.
- Reassess toll charging to ensure tariffs are set at a fair rate. Ideally, the rates at which vehicles are charged should be consistent across the whole network.
- Ensure all tolls are inclusive of separate infrastructure and (air and noise) pollution costs. Toll rates should be differentiated so that more polluting vehicles pay substantially more than cleaner vehicles on the road.
- Extend the toll charge for HDVs to all roads so that the damage they cause is accounted for wherever they drive. This will additionally prevent HDVs from using secondary roads to avoid the toll, and so relieve congestion on those roads.
- Implement distance- and pollution-based road toll for cars and vans on all roads.

- Implement urban road pricing in Budapest.

6.3. Fuel taxes and tax reform

- As a complementary measure to distance-based road charging, Hungary should engage in discussions with neighbouring countries to align their diesel tax rate to the of petrol, and should consider increasing excise duty to be more in line with the EU average. Collaboration on this measure is important so as to avoid so-called ‘fuel tax tourism’; this occurs when truck drivers divert to countries with low fuel tax to refuel. This tax avoidance both increases traffic concentration in certain areas and reduces the ability of neighbouring countries to use fuel tax as a tool to reduce greenhouse gases.
- The rebate offered to truckers of €0.036/litre (11 HUF/litre) in Hungary should be scrapped.
- Car taxation should be reformed so that it will be no longer advantageous to account the purchase and use of cars for private purposes as if these were for company purposes.

6.4. Investments

- Spend no public money (including EU money) to support road construction, operation and maintenance; their costs should be paid by the users.
- Enhance green public procurement concerning transport investments.

6.5. Shifting car passengers to buses, trains, cycling, and walking

- Require cities to produce and implement sustainable urban mobility plans which substantially reduce transport emissions in the next few years.
- Invest in high quality, affordable public transport.
- Ensure priority of public transport in traffic.
- Share relevant data with other transport providers and internet mobility platforms to enable Mobility as a Service (MaaS) and offer a real alternative to private car ownership (among others by car-sharing and carpooling).
- Improve the city infrastructure to encourage walking and cycling. This should lead to public space reallocation with less road space for cars, and more bike and pedestrian facilities.
- Introduce measures to encourage bike sharing, including appropriate locations for shared bikes, larger bike lanes, adequate street signs as well as implementing pedelec-sharing systems
- Implement low emission zones and traffic calming. Reduce the number of car parking slots and increase parking fees to incentivise the use of public transport and non-motorized modes.
- Incentivise the preparation of workplace mobility plans.
- Transform land use planning in order to reduce the need for car transport.
- As Hungary will implement the Fourth Railway Package in the coming years, it is imperative that passengers are protected in instances where a connecting train is missed due to a late train (even when the operators of the two trains are different companies). Furthermore, as new entrants enter the railway market, the Hungarian Competition Authority must ensure that the legacy operator is allowing new entrants to show train times on station departure boards and allow new entrants sufficient access in train stations to all of the necessary infrastructure for ticket sales (e.g. advertising, ticket machines, and ticket desks).

6.6. Putting more passengers in each car

- Introduce adaptive and congestion-dependent urban road pricing as a policy to reduce private car use.

- Facilitate the use of short and long distance car and ride sharing, as the occupancy of these vehicles is above average.
- Adapt fiscal incentives to deter private car use: end tax benefits for company cars, eliminate tax evasion and tax avoidance committed by accounting the purchase and use of cars for private purposes as if these were for company purposes, equalise taxation between petrol and diesel.

6.7. Eco-driving, speed limits and communicating intelligent transport systems (C-ITS)

- As shown in this report, eco-driving has a potential to reduce CO2 emissions from vehicles but to be effective, most or all drivers need to employ eco-driving, especially on the long term that would require regular trainings or better, mandatory use of eco-driving modes on cars that would moderate how the car is driven to maximise efficiency. Car manufacturers have been pushing the European Commission to qualify eco-driving as an eco-innovation. However, it does not qualify as an eco-innovation as there is no guarantee that the driver will use or respect it, creating here an important loophole. A mandatory system would however qualify. A simpler approach to encourage eco-driving is simply to rigorously enforce speed limits that achieves similar benefits.
- Use C-ITS for better traffic management.
- Implement unified, compatible timetables and tariffs for all public transport within Hungary.
- Introduce on-road remote control of emissions.

6.8. Shifting freight from trucks to trains, reducing road freight transport

Shifting freight to trains, and ideally electrified trains, requires a holistic and concerted approach for policy and investment. There are a number of measures that can help to achieve shifting more freight from road to rail in Hungary.

- Apply a moderate rail track access charge so that rail becomes cost-competitive with road.
- Eliminate speed restrictions on railway lines.
- Modernize the railway freight rolling stock.
- Eliminate the unnecessary obstacles of establishing side-tracks.
- Improve the flexibility and speed of freight services by investing in rail infrastructure that's not as complex or time-consuming as large cranes. (For example, a company in Switzerland has developed a system[clxxxii,clxxxiii] whereby special trucks can quickly load containers and trailers from trucks to trains and vice-versa.) The infrastructure is not expensive but there's a lot of potential to improve the ease at which trains are loaded.
- Make it easier to implement one-wagon transport as today it is extremely difficult to order freight transport on only one or two railway wagons (the railway company either simply refuses or sets the price too high).
- Provide transparent calculations on the sum provided from the state budget for track use and maintenance, and for passengers.
- Promote the use of cargo bikes.
- Incentivise local production and consumption.

6.9. Aviation and Shipping

Although these modes were not explicitly modelled and fall out of the framework of the CAR, aviation and their associated emissions are significant in the Hungarian transport sector. Although emissions from ships are relatively small, they cause significant air pollution locally, emitting huge quantities of diesel fumes (containing black carbon, an important climate pollutant), therefore measures to reduce these emissions should be implemented, too. Hungary can push for the following measures to ensure that all these emissions are properly regulated and kept at bay.

Aviation:

- A ticket tax on flights could yield significant revenues (€72 million based on 2016 passenger numbers) and help curb demand, helping to combat excessive tourism.
- Contribute to retaining and reforming the EU ETS as a means of introducing more effective carbon pricing and put the sector on a long-term path to decarbonisation.
- End the sector's kerosene tax exemption, starting with domestic aviation, and using Article 14 of the Energy Taxation Directive to begin ending the exemption for intra-EU flights.

Shipping:

- Implement tighter air pollution standards for ships calling at Hungarian ports, both for SOx, NOx and PM emissions;
- Making on-shore power supply available, especially for RoRo and cruise ship terminals.

6.10. Horizontal measures

- Provide substantially more resources for public awareness raising as it is the most cost-efficient method to help reduce CO2 and other harmful emissions.
- Strengthen the institutional background of sustainable transport.
- Improve the working conditions for environmental NGOs dealing with transport as they play an indispensable role in promoting climate-friendly transport systems.
- Enhance R&D concerning environmentally sustainable transport.

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