CLIMATE ANALYTICS

Behavioural changes and transport sector decarbonisation

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Supporting science based policy to prevent dangerous climate change enabling sustainable development

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Introduction

Habits are important, but often overlooked barriers to climate change goals

Despite decarbonisation targets and efforts, emissions from the transport sector have been increasing over the last three decades. Total greenhouse gas (GHG) emissions in transport increased by more than 33% between 1990 and 2019 and road transport emissions by almost 28%.[1]

Of these emissions, the largest share was from passenger cars (44%) and only 19% came from heavy-duty vehicles.[2] Projections show that without additional measures, transport emissions will continue to increase through 2025 and reach 9% above 1990 levels in 2030.[3]

Without abatement, transport emissions alone could take up the entire carbon budget allotted to the EU under 1.5ºC compatible pathways outlined in the Paris Agreement.[4,5]

Transport emissions remain a significant obstacle to meeting EU climate change goals, and reducing car travel is the most effective way to cut emissions per capita.[6]

At the same time, current mobility management is failing to increase transportation efficiency. One of the main reasons why national governments fail to reach agreed policy goals is sticky public behaviour. The way individuals behave and their preferences shape environmental policies and to a large extent determine their success and the failure.

Despite this, habitual behaviours are often not considered important factors to account for while developing policy. Regardless, human behaviour is at the root of the sustainable mobility challenge we face today, and a key component to successful policy development.

It is impossible to achieve sustainable mobility without changing travellers' behaviour. Mobility management based on changing habits is simultaneously the least resource-intensive and the most resource-saving approach to policymaking. The potential for behaviour changes to support GHG reduction was highlighted in the IPCC Sixth

[1] Decarbonising road transport – the role of vehicles, fuels and transport demand. Transport and environmental report 2021, No 02/2022
[2] EEA: Share of transport greenhouse gas emissions, 2019
[3] EEA: Greenhouse gas emissions from transport in Europe, 2022
[4] Buysse C., Miler J.: Transport could burn up the EU's entire carbon budget, 2021
[5] Tagliapletra S., Zachmann G.: Addressing Europe's failure to clean up the transport sector, 2018
[6] Ivanova D., Barret J., Wiedenhofer D., Macura B., Callaghan M., Creutzig F.: Quantifying potential for climate change mitigation of consumption options, 2020

Assessment Report and has been clearly demonstrated.[7,8,9] However, it often takes a long time for changes to take effect and individuals and leaders play a crucial role here.

Targeted behaviour change is a complex process, and it is not the purpose of this paper to provide guidance on how to do it.[10] This horizontal paper identifies important patterns and key priorities and provides recommendations to influence the shift from personal car usage to more sustainable modes of mobility.

Sticky behaviours

'Car stickiness' surveys show that cars are chosen more often than other means of transport, even if another mode would have been a better option in terms of price or travel time.[11] Modern society and infrastructure developed around car dependency and this mode of transport has also become a sign of more nebulous values, such as freedom, independence, status and fashion.

Car stickiness is therefore driven by two intertwined issues: lack of alternatives, and the high perceived value of personal vehicles.

Choice of travel mode is determined by a variety of subjective attitudes that must be considered when improving public transportation or developing other transport policy. These subjective attitudes could explain why free public transport may be perceived as social support rather than as a measure to reduce car usage. In addition, 'car stickiness' in general can be characterised by resistance to economic measures. At the same time, incentives to provoke changes in travel mode might not always be as effective as regulation-based policies, such as the introduction of low emission zones.[12]

Rising incomes have led to higher car ownership. Previously considered a sign significant wealth, for many today a personal car has become an item of daily usage. A UK survey shows that 74% of people say that having a car is essential to their everyday life, with this number rising to 83% for those living in rural areas. Without a car, 51% would not be able to visit their family, 27% would not be able to go to the doctor and 8% would be unable to transport their children to school. These numbers are higher for those who live in rural areas. Over 60% of respondents say they would struggle to go food shopping without a car (compared to the average number of 45%), and 47% would struggle to get to a train station or airport (versus 24% on average). But only 38% of

[7] Akenji L.: 1.5-degree lifestyles: Targets and options for reducing lifestyle carbon footprints, 2019
[8] Van de Ven D-J., Gonzalesz-Eguino M., Arto I.: The potential of behavior change for climate change mitigation: a case study for the European Union, 2017
[9] Labouze E., Monier V.: Study of external environmental effects realted to life cycle of products and services, 2003
[10] Promoting mobility behaviour change, 2019
[11] Innocenti A., Lattarulo P., Pazienza M. G.: Heuristicts and biases in travel mode choice, 2009
[12] ibid

respondents cannot get to work without a car (31% on average).[13] Furthermore, studies show that car ownership increases employment opportunities.[14] For many, driving is not only a choice, but also a necessity.

Considering the critical place cars have in the daily lives of many, when developing policy measures, attention should first be paid to areas where alternatives to private cars are available and are being developed: agglomerations, cities, towns, and district centres.

Policies and measures that intend to reduce GHG emissions from passenger transport can be divided into three groups depending on the area they target.

- **Measures focused on absolute reduction.** These measures aim to reduce physical amounts of goods or services consumed. In the context of passenger transport, this often means addressing car ownership and miles driven.
- **Measures focused on improving efficiency.** With the help of these measures, existing technologies are replaced by lower-carbon technologies without addressing consumption volumes. Electrification, lower-emission engine technologies, and biofuels are among these measures.
- **Measures focused on the modal shift that change consumption patterns.** Shifting from private vehicle usage to public transport, walking or cycling reduces carbon emissions in the passenger transport sector.

Policies and measures that target behavioural change generally fall into three broad archetypes – incentives, regulations, and education. Incentive measures are the most broadly accepted type of policy because they make changing habits beneficial to the individual. Direct financial incentives (such as subsidies or tax exemptions) may be designed in a way that could lead to negative consequences in the long run. In some cases, habits may be so sticky that individuals would only be influenced by the provision of a direct financial incentive, which can become a fiscal burden.

Looking towards societal impact, in some cases a part of the public may believe that the changes being sought are the result of interest groups seeking influence in shifting markets. Certain segments of society may view the government's efforts to solve climate change and similar global problems with significant mistrust. While some doubt and others wait for incentives, the implementation of necessary measures is delayed.

Regulatory measures focused on changing public habits are usually unpopular and often have a high political cost. As a result, politicians are not eager to implement such measures. The Netherlands introduced a 100 km/h limit solely because it was obliged to implement a ruling as a result of a decision by The Hague Court which concluded that

[13] Aulakh S.: Owning a vehicle considered essential for everyday life, 2018
[14] Chatterjee K., Clark B., Nguyen A., Wishart R., Gallop K., Smith N., Tipping S.: Access to Transport and life opportunities, 2019

the government must drastically reduce GHG emissions. All other mitigation measures were exhausted or proved even more difficult to implement. The public was broadly non-responsive, with a survey showing 46% did not plan to comply with the new speed limit.[15] Despite the controversy on the ground, in the political sphere this measure did not prove to be as politically costly as assumed, resulting in the party that introduced it winning the elections for the fourth time in a row.[16]

Measures supporting consumer education are an important tool for achieving societal behavioural changes because consumer attitudes, values, and knowledge can contribute to environmentally sustainable behaviours. Although environmental attitudes affect mobility patterns, connection between the two is neither significant nor widespread.[17,18] All of the shortcomings of the incentive and regulatory measures discussed could be significantly mitigated if more people were knowledgeable about the impacts of the climate change crisis, its causes and societal responses. However, education takes time and educational measures may operate on longer timescales than other policies. Given the urgency of the climate crisis, educational measures are best suited for use in combination with other approaches.

One educational initiative is the use of CO_2 calculators that can help evaluate the CO_2 footprint of a trip or commute and educate individuals about the impact of their decisions. In the same vein, successful competitions between secondary schools were organised in Belgium and later repeated in Lithuania aiming to find out which school has the lowest CO_2 footprint from student commutes.

Such competitions can provide opportunities to investigate the impact of our habits on the environment, leading to a better understanding and acceptance of necessary regulatory measures to reduce CO_2 emissions. Similar competitions and pledges can also be promoted at the company or city level, promoting voluntary commitments to reduce the environmental impact of individual choices around sustainable transportation.

[15] DW: Netherlands reluctantly introduces new speed limit, 2020

[16] However, it is necessary to note that targeting agriculture as part of climate change mitigation measures raised a huge wave of dissatisfaction among agriculture workers. The new party "Farmer-Citizen Movement" (BoerBurgerBeweging) won the most seats in all 12 provinces in March 2023, while at the same time approval rating of the Dutch Government dropped to 20%, its lowest rate in a decade.

[17] Zavereh M. F., Mehdizadeh M, Nordfjærn T.: Active travel as pro-environmental behaviour: an integrated framework, 2020

[18] Flamm B.: The impacts of environmental knowleadge and attitudes on vehicle ownership and use, 2009

Challenging consumption attitudes and supporting shared transportation

In many countries of Eastern Europe, passenger cars are perceived as a status symbol, signalling wealth and prosperity. Countering these attitudes and divorcing conceptions of wealth from vehicle ownership will be key to decarbonising passenger transport. In doing so, shared transportation and not owning personal vehicles can be destigmatised. Shared transportation enables more rational use of resources, greater efficiency and reduction of the volume of transport-related goods produced, decreasing industrial pollution.

Over two-thirds of Lithuanians express positive attitudes towards sharing their belongings and resources with others. Among collaborative platforms which foster sharing, in Lithuania, transport services are the most popular. Within the user-base these services are popular, but they are relatively unknown among the broader population. While a majority of users recommend such services, 97% of Lithuanians have never offered to share services via collaborative platforms, and two-fifths do not know what these collaborative platforms are.[19] These findings are similar to the EU average,[20] revealing the significant opportunity to leverage the sharing economy to support transport decarbonisation.

Improvement of the regulation of open collaboration platforms is essential to achieve greater transparency and security for all participating parties. Clearly described legal rights, simplification of contractual procedures, and establishment of economic and social regulation mechanisms can improve transparency and lead to greater utilisation of car sharing services.

Looking beyond concerns about wealth signalling and the sharing economy, convenience and ease of use in emergency situations are common barriers tied to car ownership. In most cases, car sharing or car rental options can provide a similar level of convenience to private cars. The possibility to reserve a ride share in advance and simpler car rental procedures using already available platforms make these services more attractive and convenient. Local governments could additionally use available means to secure better service coverage, where market instruments are not enough, protecting mobility as a right.

In case of an emergency – an often quoted reason for car ownership – personal cars can often be substituted by taxi services. Of course, in extreme emergency cases or in rural areas, it would be difficult to find a relevant replacement. Therefore, the threat of various natural cataclysms, military unrest, or pandemics are factors that have a negative effect on efforts to reduce private car usage. The COVID-19 pandemic strongly

[19] Česnuitytė V., Dromantienė L., Bernotas D., Banytė J., Vitkauskaitė E., Vaičiukynaitė E.: Sharing Economy in Lithuania: Steady Development with Focus on Transportation Sector, 2021
[20] The use of the collaborative economy, 2018

pushed consumers towards individual car usage[21] and this negative mobility behaviour change is likely to stick long after the pandemic.

Once a car is purchased, it is difficult to expect that the car owner will choose alternative forms of travel, unless severe restrictions make usage expensive or inconvenient. Having a highly developed 'car culture', it is hard to introduce strict measures, as car owners have expectations and seek to protect their mobility preferences. If measures are timely (e.g., just before streets reach their full capacity) or sufficiently targeted, changes in the level of car ownership can be achieved in the long run by discouraging ownership of additional cars in the same household.

Regulatory measures, such as a sufficiently high car registration fee that has a direct impact on the purchase price is a powerful, but also extremely unpopular measure. Denmark, which introduced a registration tax in 1910, can maintain a high taxation level because it has well-developed public transport infrastructure and, almost importantly, a corresponding mobility culture. The Danish example clearly shows how a regulatory measure adopted early enough, before it affects a large part of the population, can be successful and long-lasting. This also partly explains why countries are struggling to introduce dedicated taxes (for more information on car taxes in European countries see The Good Tax Guide).[22] There is no reason to expect that a similar measure could be implemented in any Central and Eastern European country or even in most Western European countries now under existing circumstances and with large shares of car users.

Fast, reliable, frequent, and user-friendly public transport has the potential to serve as a substitute for private cars for daily commuting. Targeted advertisements, ticket discounts, and free transport days could be simple and effective incentives to highlight public transport opportunities and advantages and encourage their usage. Additionally, if the transport system is designed to prioritise public transport (for example by giving green lights first for public transport at intersections) it can be made even more competitive to other means of transportation in terms of travel speed. Greater accessibility of public transport stops and the quality of pavilions are important components of user satisfaction – poorly maintained and low-lit accesses and pavilions deter public transport usage.

The second group of measures focuses on overall mileage reduction. The most important incentives to reduce car mileage can be introduced at the city level by adapting targeted urban planning measures. Sufficient networks of schools, curbing urban sprawl, and promoting mixed-use zones with business compatibility checks, are measures to which citizens do not need to adapt specifically. By implementing sustainable urban planning practices, we can create an environment that is more convenient, and driving is less necessary.

[21] https://www.beuc.eu/sites/default/files/publications/beuc-x-2020-124_mobility_habits_following_covid-19.pdf
[22] Transport & Environment: The good tax guide: A comparison of car taxation in Europe, 2022

At the same time, even in a well-planned city, regulatory measures to reduce congestion might be needed. Studies prior to the COVID-19 pandemic showed that remote work can help to reduce congestion by decreasing the number of vehicles on the streets during rush hours.[23] These findings were clearly confirmed in practices during and after the pandemic as a large share of the population worked from home both as a matter of public health, and following the end of the pandemic, a matter of preference. Creating conditions for those who can work remotely is one way to reduce the number of cars on the streets and consequently mileage.

However, there is a risk that the decrease in mileage by be counterbalanced by increasing number of drivers who previously avoided commuting. Reduced trips to the workplace could be substituted with other trips or longer more infrequent trips if remote flexibility leads to individuals living further from their workplace. Therefore, remote work does not necessarily mean lower CO_2 emissions per se, and if offered as a measure to mitigate climate change impacts, it should be accompanied by certain limitations.

Taxes on CO_2 emissions, fuel, or mileage are the most straightforward fiscal instruments aimed at reducing consumption intensity. These taxes are motivated by the 'polluter pays principle' as the tax is directly linked to mileage. According to calculations by Transport and Environment,[24] an increase in petrol, diesel and natural gas fuel taxes by 10% would decrease fuel consumption by 3-5%.

Other measures include emission-linked registrations or an annual car tax, if well balanced, is an effective fiscal measure which can lead to car fleet changes in the long run, as it incentivises the purchase of lower polluting vehicles, with a higher surcharge for higher polluting vehicles. It should be noted that taxes on car usage are regressive, applying to everyone regardless of whether individuals have access to alternative modes of transport and regardless of income.

Challenges to electrification

Breaking transport dependency on oil and gas is an important step towards decarbonisation and requirements for biofuels and emissions standards are legislative measures that do not require habit changes. However, choosing the type of car itself is a voluntary act. The aim is for the choice to be driven by environmental considerations, which can be reinforced by incentives or tax measures.

[23] Andrey J. C., Burns K. R., Doherty S. T.: Toward sustainable transportation: Exploring transportation decision making in teleworking households in a mid-sized Canadian city. Canadian Journal of Urban Research, Vol. 13-1, p. 257-277. 2004

[24] Transport & Environment: Roadmap to decarbonizing European cars, 2018

A survey among electric car users and those interested in electric cars conducted in Lithuania in 2022[25] showed that a plurality of respondents preferred electric cars because of comparatively low operating costs.[26] Only 13% of respondents who preferred electric cars indicated that they care about the environment, while 10% indicated their preference for EVs was because of existing exceptions for electric vehicles that allows them to use public transport lanes and have free parking.

Purchase price and driving range are the main barriers to a faster transition to electric vehicles. Financial support schemes, reduced VAT, and parking fee exceptions for companies, and other incentives in combination with taxes on CO_2 emissions could sufficiently challenge the price barrier. Promotion of expanded electric car charging infrastructure, simplification of installation procedures in multi-apartment courtyards, and investing in built-in fast-charging technologies could help overcome range limitations and make electric cars more convenient for a wider range of user needs.

As the 2022 Global Electric Vehicles Outlook[27] shows, over 16.5 million electric cars were on the road in 2021, a tripling in just three years. Electric car sales accounted for 9% of the global car market in 2021 (17% in Europe) – four-times their market share in 2019. In 2021, several major automakers (Volvo, Mercedes, Ford, etc.) announced plans to accelerate the transition to a fully electric future.[28] However, on the EU level there was some steps back from a complete ban on ICE vehicles starting in 2035. Despite a vote approving the 2035 deadline in the EP, the EU agreed to continue to permit sales and registration of ICE models after 2035 — provided those vehicles operate only on carbon-neutral e-fuels.[29]

Hybrids, plug-in hybrids, and hydrogen-powered vehicles additional low-emission options. However, only battery and hydrogen fuel-cell vehicles have the potential to be very low-emission passenger vehicles.[30,31.] Due to the physical properties of hydrogen as an energy carrier rather than energy source, and current hydrogen technologies have low energy return of energy invested (EROEI),[32] it is unlikely that hydrogen will play a significant role in the road transport sector on a wider scale, and therefore other decarbonisation solutions should be prioritised.

Looking towards battery-electric vehicles (BEVs), the carbon footprint of an EV is highly dependent on the energy generation mix that it uses to charge. Some suggest a

[25] Unpublished data of survey performed by L. Stoškus in July, 2022
[26] The survey was conducted prior electricity prices began to rise drastically
[27] IEA: Trends in electric light-duty vehicles, 2022
[28] ibid
[29] https://www.euronews.com/green/2023/03/22/eu-to-ban-petrol-and-diesel-cars-by-2035-heres-why-some-countries-are-pushing-back
[30] Bieker G.: A global comparison of the life-cycle greenhouse gas emissions of combustion engine and electric passenger cars, 2021
[31] Zheng G., Peng Z. J.: Life Cycle Assessment (LCA) of BEV's environmental benefits for meeting the challenge of ICExit (Internal Combustion Engine Exit), 2021
[32] Palmer G., Honnery D.: Life-cycle greenhouse gas emissions and net energy assessment of large-scale hydrogen production via electrolysis and solar PV, 2021

threshold of 320 gCO_2/kWh (or roughly the UK's emissions intensity) for the electrification of transport to be justified.[33] In countries where CO_2 emissions from primary energy generation exceed this level, financial support for electric vehicles should be provided if the buyer can generate the required amount of energy for the electric vehicle from renewables (e.g. a buyer has installed a solar panel, or has an electricity contract that guarantees that the electricity used for car charging is coming from renewable sources).

Challenging modal shift

Cycling infrastructure and increasing cycling lane networks is essential for boosting activity levels for this mode of transport. Development of cycling lanes and spread of e-bikes allows for a greater number of destinations to be reachable by bike. Infrastructure improves safety for all those using the road and helps cyclists feel safer during their journeys.

Conditions to increase walking must first be outlined in the spatial planning documents. Footpaths should be constructed in a such way that one could reach destinations efficiently. Sidewalks must be separated from roadways, preferably located under a tree canopy, and be maintained properly year-round. Street crossings should be safe and pedestrian friendly.

Reducing vehicle speed limits in urban areas, where pedestrian traffic is heavy, is necessary, but widely unpopular in many Eastern European countries. The layout of the street in such places must force the driver to reduce speed. Since a significant portion of the population still does not understand what 'induced demand' is (where adding new street lines results in increased traffic and traffic jams), it needs to be addressed and considered before implementation of any regulatory plans. Public education in this regard is essential.

Conclusions

Considering the rapid depletion of material resources, we see an increasing number of areas where not only conventional business models, but also our daily activities and habits must be rethought and readjusted to reduce emissions from the transport sector. Adapting habits may be the most difficult step, and we must find incentives to persuade ourselves to move away from what we are used to.

Changing mobility behaviour is an urgent issue and identifying which measures are the most effective will be critical to addressing this in a timely manner. Classic economic

[33] Zheng G., Peng Z. J.: Life Cycle Assessment (LCA) of BEV's environmental benefits for meeting the challenge of ICExit (Internal Combustion Engine Exit), 2021

instruments, incentives, and education all offer unique benefits, but come with limitations as well. The end goal is simple: measures that align mobility with sustainable goals and are acceptable to society.

Behavioural change is not based on an information deficit, but on attitudes and beliefs.[34] Social acceptance level grows with area-education and educational efforts will have to be the basis for any changes. Education alone is not sufficient: individuals must be persuaded that behavioural changes will bring benefits to their lives. It is recommended to focus on influencing people's attitudes or social behaviour at earlier stages and on influencing their beliefs at later stages of change.

[34] Sadeghian Sh., Wintersberger Ph., Laschke M., Hassenzahl M.: Designing sustainable mobility: understanding users' behaviour, 2022


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