Sufficiency in transport policy – an analysis of EU countries' national energy and climate plans and long-term strategies

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Abstract

On the pathway to climate neutrality, EU member states are obliged to submit national energy and climate plans (NECPs) with planned policies and measures for decarbonization until 2030 and long-term strategies (LTSs) for further decarbonization until 2050. We analysed the 27 NECPs and 15 LTSs submitted by October 2020 using an inter-rater method. This paper focuses on energy sufficiency policies and measures in the transport sector.

We found a total of 236 sufficiency policy measures with more than half of them (53 %) in the transport/mobility sector. Additionally, we found 41 measures that address two or more sectors (cross-sectoral measures). From the explicit sufficiency measures within the transport sector, 82 % aim at modal shift. A reduction of transport volumes is much less addressed. Countries plan to use mainly fiscal and economic instruments. Those are in many cases investments in infrastructure of low-carbon transport modes and taxation instruments. Plans on decarbonisation measures are also frequently mentioned. The majority of cross-sectoral measures are carbon taxes or tax reforms, also economic instruments.

On the one hand it is encouraging that Member States strongly emphasize the transport sector in their NECPs and LTSs – at least quantitatively and concerning sufficiency measures – because this sector has been the worst-performing in climate mitigation so far. On the other hand, the measures described seem not sufficient to reach ambitious climate targets, and we doubt that the presented set of policy instruments will get the transport sector on track to mitigate greenhouse gas emissions in the necessary extent.

Introduction

In order to achieve the climate targets of the Paris Agreement, the European Union aims at a decarbonisation of European energy systems and at achieving net zero emissions by 2050 (EC 2019). In the interim, the EU has already committed to a binding target of minimum 40 % greenhouse gas emission reduction by 2030 compared to 1990 (EC and Council of the European Union 2018). Discussions about a more ambitious target are currently ongoing and part of Trilog negotiations: The EU-Commission intends to raise the target to minus 50–55 % in its draft Climate Law under the European Green Deal (EC 2020d) and several studies show the feasibility and the benefits of an even more ambitious target of a 65 % reduction until 2030 (CAN 2020). An important policy mechanism in the context of the EU climate ambition is the commitment of EU member states to develop a vision for 2050 with national Long-Term Strategies (LTS) (EC 2020c). Short-term implementation roadmaps for 2030 and subsequent decade-steps are laid down in National Energy and Climate Plans (NECP) (EC 2020b), whose reporting periods are aligned with UNFCCC schedules (EC 2019).

To achieve net-zero emissions by 2050, a profound transformation of the entire energy system and respective demand and supply patterns needs to take place. This encompasses the stringent application of all technological options on the supply

side (ramp-up in renewable energy supply) as well as on the demand side (maximum energy efficiency implementation) and reductions in demand through behavioural and structural changes (Creutzig et al. 2018; Hainsch et al. 2020). All these options require respective conducive and enabling policy frameworks.

On the path to climate neutrality, the transport sector, which accounts for a quarter of EU GHG emissions, remains the biggest challenge: while, since 1990, all other sectors have seen a decline in emissions of 20–50 %, transport emissions have *increased* by about 20 %, of which three-quarters stem from fossil-fuelled road transport, the rest essentially from navigation and aviation (EC 2021). According to standard transport research and planning (TUMI, SUTP, and GIZ 2019; Zamora 2014), three key strategies for emissions reduction are available: avoid/reduce, shift/maintain (especially to non-motorised and public transport) and improve (efficiency). Fuel switch (e.g. to H_2, synthetic fuels [syn-fuels] or electricity) may be defined either as shift (in energy carrier) or efficiency (in emissions/km) improvement. This categorisation is largely consistent with a framework used in energy research which also covers other sectors: the notion of sufficiency, consistency and efficiency (Bierwirth and Thomas 2015; Samadi et al. 2017).

The EU Commission names key strategies for decarbonisation of the transport sector: (1) increase of the "efficiency of the transport system" (esp. shift to lower-emission modes), (2) "deployment of low-emission alternative energy" including bio- and syn-fuels and zero-emission vehicles. Additionally the role of local planning and implementation is highlighted (EC 2021). An "avoid/reduce" or sufficiency strategy is not explicitly mentioned. This is surprising considering the historical development of ever-increasing (individual) motorisation rates, travel distances, increasing vehicle and engine sizes overcompensating gains in motor efficiencies and often the dismantling of public transport infrastructures (Tsoi, Loo, and Banister 2021). A low-carbon mobility transition needs to reverse these developments, pursuing also the avoid (or reduce/sufficiency) strategy, with a respective policy framework (Martin et al. 2020).

Therefore, this paper presents a systematic assessment of transport sufficiency measures that European member states lay down in their NECPs and LTSs submitted to the EU Commission in 2019/2020 to get an overview of implemented and planned measures within this sector. We first outline our proceedings and sufficiency understanding in the methods chapter, followed by an analysis of content, instrument type and policy target of the identified measures. Based on our results, we discuss reasons for uncertainties e.g. concerning the characteristics and extent of the measures found and draw conclusions for European transport policymaking.

Methods

ANALYSIS BASE: NECPS AND LTSS

Our research objects are final NECPs and LTSs available from the websites of the European Commission (NECPs: EC 2020a, LTSs: EC 2020b). For those reports that were only available in national language and where our team was not able to understand the original document, translation tools were used to translate the reports.

We considered all documents available by October 2020 (with the only exception of the Finnish LTS that became available too late). We thus included the NECPs of all 27 EU member states as well as 15 LTSs in our analysis.

SYSTEMATIC SUFFICIENCY MEASURE COLLECTION

A team of six researchers extracted all sufficiency-related measures from the documents. This was done by searching keywords (sufficiency, sufficient), checking their meaning and by direct content searching. Only measures that are either already implemented or planned were collected. Visions (especially from LTS) are included when referring to concrete policy measures.

We clustered the identified measures by sector. For this analysis we consider the measures found in the mobility/transport sector. We also found cross-sectoral measures that address several or all sectors (e.g. carbon taxes). These were also included in this analysis. We developed a definition of sufficiency for this analysis to categorise the measures identified (see next subsection). This was necessary to distinguish between sufficiency, efficiency and consistency measures because boundaries are not always perfectly drawn (Toulouse, 2020). In order to ensure inter-coder validity and consistency of the analysis, we proceeded as follows:

- assignation of analyst/coder to country (random + language skills)
- screening of NECP/LTS, extraction of policy measures into database, coding: categorisation by sector, sufficiency type/policy target and instrument type
- (random) assignation of peer analyst/reviewer by country
- second-round analysis, measure extraction and coding by blind peer-author
- comparison and discussion of findings/inconsistencies between coders
- by-country consolidation of findings between authors.

In regular coder meetings, a common understanding for the coding was elaborated whenever questions arose. In the consolidation phase, the two respective coders implemented the common understanding in the categorisation to ensure comparability of policy measures across countries.

EFFICIENCY, CONSISTENCY, SUFFICIENCY

Efficiency, consistency and sufficiency are three strategies identified in the literature (Samadi et al. 2017; von Winterfeld 2002) towards achieving sustainability. In the energy domain, efficiency typically refers to a reduction of the energy input/service output relation, consistency typically to a switch to sustainable inputs (i.e. renewable energy sources). Sufficiency is the least established and known strategy and will thus be explained in more detail below.

Sufficiency refers to some form of reduction in energy services (see e.g. Brischke and Thomas 2014 and literature below) but the existing literature on energy sufficiency is based on various understandings of the concept and consequently there is no congruent definition of the term energy sufficiency (for definitions see e.g. Fawcett and Darby (2019); Raworth (2017); Fischer et al. (2013); Brischke and Thomas (2014); Samadi et al. (2017); Vita et al. (2019); Shove (2018); Schneidewind and

Zahrnt (2014); Moser et al. (2015); Vadovics and Zivcic (2019); Toulouse et al. (2020); Sorrell et al. (2020)). Sufficiency definitions vary over several dimensions: whether accounting for changes in behaviour and society, or also including technological sufficiency options, in the perception of sufficiency as a state (level) or as a process (change) (Heyen et al. 2013). There is also disagreement, whether sufficiency only refers to a reduction or may also be a more general shift towards sustainability (most authors agree). Some authors not only focus on upper limits but also at lower bounds of "enoughness" they consider necessary to be met as being "sufficient" (see e.g. Raworth (2017); Fawcett and Darby (2019)).

On the basis of this literature, the definition of sufficiency that we applied for this assessment, reads as follows: **"Energy sufficiency is the strategy of achieving absolute reductions of the amount of energy-based services consumed, notably through promoting intrinsically low-energy activities, to reach a level of "enoughness" that ensures sustainability"** (see Zell-Ziegler et al. forthcoming).

The distinction between these strategies is not always clear, e.g. for measures that involve a significant reduction in an energy-intensive behaviour or service (e.g. of fossil-fuel car driving) and its substitution by a more sustainable behaviour that still, however, has a non-negligible energy demand (e.g. public transport). Such measures are a mixture of clear sufficiency-related measures with a consistency or efficiency element. There is separate literature on this (Heyen et al. 2013; Toulouse 2020), but the debate is beyond the scope of this article.

The NECPs and LTSs are sometimes vague about the strategies that drive the prescribed policies and measures. This complicates the evaluation of sufficiency contents. We therefore account for all policies that *potentially* cover sufficiency measures as defined above. In addition, we include cross-sectoral measures that have the potential to promote sufficiency action next to other strategies, mainly efficiency.

CATEGORISATION OF MEASURES BY SUFFICIENCY TYPE AND POLICY TARGET

In order to cluster the extracted measures, we categorised them according to their "sufficiency type" or policy target: We found measures aimed at reducing energy service levels (and sometimes explicitly termed as such) or reducing certain demands but at the cost of shifting (part of the) demand to other still energy-based means/services. We termed this *substitution*. A third category we found includes measures that alter the general framework supporting any energy savings irrespective of their nature, either in a specific sector or across sectors.

Translated to the transport sector, the policy targets can be described as 1) reduction of km, 2) modal shift and 3) general supporting. Measures aimed at improving transport efficiency (e.g. more efficient engines) or shifting from internal combustion engines to alternative fuels (electricity, gas, other) are not aimed at reducing individual motorised transport but as improving technical efficiency or consistency (i.e. fuel switch to renewables) and not as reducing energy services. They are thus not considered in this analysis as sufficiency measures.

CATEGORISATION OF SUFFICIENCY MEASURES BY INSTRUMENT TYPE

We categorised the identified measures by eight policy instrument types according to the UNFCCC (2000): Economic (e.g. taxes, tradable certificates, market reform), fiscal (e.g. subsidies and grants, tax exemptions and public expenditures for infrastructure), voluntary agreements, regulation (laws, standards and product identification), information, education (institutional), research and development and other.

We used the category "other" to subsume plans and strategies but also other specified measures e.g. in the field of digitalisation that did not fit into other categories. We added a separate ninth category "not specified" for sufficiency measures without any specification of the measure that gave a hint on the intended instrument type. One measure can be allocated to one or multiple instrument types in our database. Table 1 gives examples of found measures by instrument types and policy targets.

Results

TRANSPORT AS KEY SECTOR OF SUFFICIENCY POLICY ACTION IN EUROPEAN CLIMATE POLICY

We found 236 sufficiency measures in total (in the sectors transport, buildings, industry, consumption and cross-sectoral). In the transport sector, we found 124 measures (53 % of total measures). 41 cross-sectoral measures were identified (see next section). Of the sufficiency measures aiming at a reduction in all sectors, transport measures make up 34 % of all reduction measures found. We found 18 sufficiency measures that explicitly address freight transport. All the other 106 measures address passenger mobility.

The total number of measures cannot effectively be compared between countries as a benchmark of ambition, as documents vary greatly in their level of detail: Some list more detailed measures and instruments and for some countries two documents, NECP and LTS, were analysed, while for some there was only one document. However, the share of transport measures within all sufficiency measures for one country can be compared (assuming a consistent level of detail across sectors) and ranges from 33 % (Croatia) to 83 % (Poland).

We underline that the sheer number of measures in the documents does not necessarily reflect the level of ambition. However, transport clearly makes up a high proportion of all sufficiency-related measures, reflecting the relative importance of the sector. Figure 2 presents the instrument types and primary policy targets of the measures we found in the transport sector.

Of the overall 124 transport measures, 82 % aim at modal shift (102), 17 % (21 measures) at a reduction of km (person-, tonne- or vehicle-km,) and one research and development measure was not possible to assign to a policy target (and is hence not included in the figure). As one measure can include various policy instrument types, the 124 identified measures are linked to 166 policy instrument types in our analysis (139 modal shift, 26 reduction, one n.a.):

- Modal shift: Every country considers modal shift measures, which include shifts to public transport/rail transport and slow modes (cycling, walking). The majority of shift measures is fiscal. For example, the Spanish NECP mentions increasing public spending on low-emission zones for non-motorised transport, car-sharing, use of non-motorised means and collective public transport (Spain 2020, p. 141–143) and more attractive night trains (Bundesministerium für Wirtschaft und Energie 2020, p. 91).

Table 1. Examples for instrument types and policy targets, encountered in European NECPs/LTSs.

	Policy target	
Instrument type	**Modal shift**	**Reduction of km**
Economic (e.g. taxes, tradable certificates, market reform)	Aviation tax, VAT rebate on long-distance rail travel, taxes on freight, congestion charging, taxes on motor vehicles	Tax reliefs for teleworking, co-working spaces, close living/working/leisure, reduction of commuting tax relief
Fiscal (e.g. subsidies and grants, tax exemptions and public expenditure on infrastructure)	Increase public transport capacity, expansion of cycling, metro and railway infrastructure, tariff reduction (even eventually free public transport), active mobility funds	Co-financing home office, strengthening server infrastructure for home office
Voluntary Agreements	Voluntary agreements with employers to promote modal shift from car to cycling	Promotion of remote working and flexible working hours
Regulation (laws, standards and product identification)	Efficiency targets for public transport, bans on parking/traffic in specific areas, speed limits on motorways	Climate/energy targets in spatial planning to reduce transport demand, privileging car-sharing e.g. on highways
Information	Access to travel information, open data, mobility service platforms, campaigns	Workplace mobility plans, campaigns
Education (institutional)	Set-up of organisations, inclusion of sustainable transport into curricula	Set-up of organisations, inclusion of sustainable transport into curricula
Research & Development	Research for infrastructure and innovations, feasibility studies, e.g. for daily night train services to several European cities	
Other (e.g. plans)	City planning, Sustainable Urban Mobility Plans (SUMPs)	Low-emission zones, teleworking/ teleconferencing promotion
Not specified (sufficiency targets are mentioned but no measures have been defined)	Development of convenient and modern public transport	Reduce need for citizens to move in general

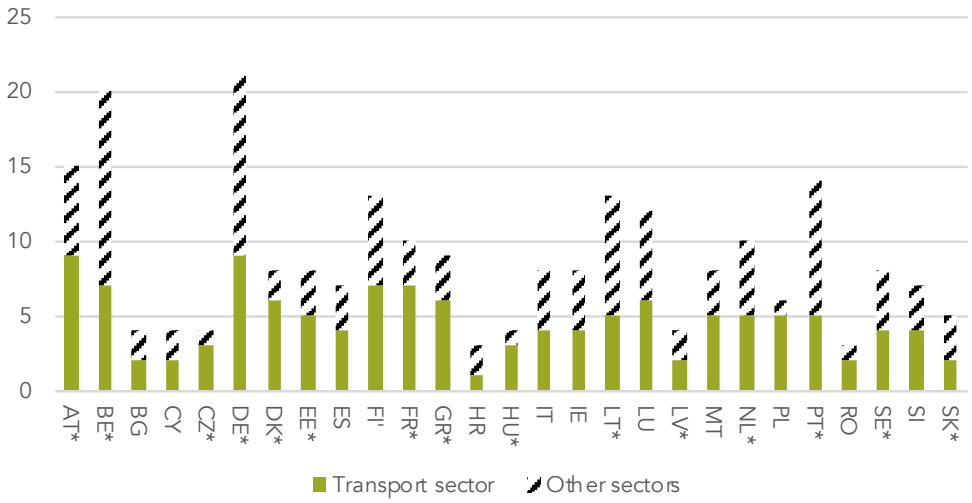

Figure 1 Number of sufficiency measures, total and in transport sector.

Note: UK as former EU member did neither submit a NECP nor a LTS until October 2020;

** asterisk: countries submitted a NECP as well as an LTS;*

' apostrophe: FI submitted both documents but the LTS came very late and only in national language so we could not process it.

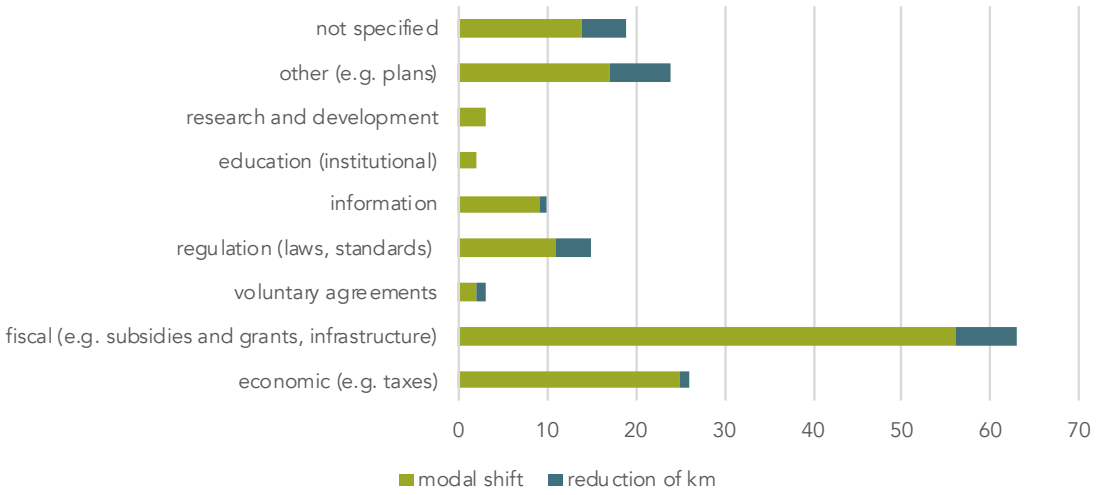

Figure 2. Sufficiency measures categorized by policy instrument types according to UNFCCC (2000) and policy targets.

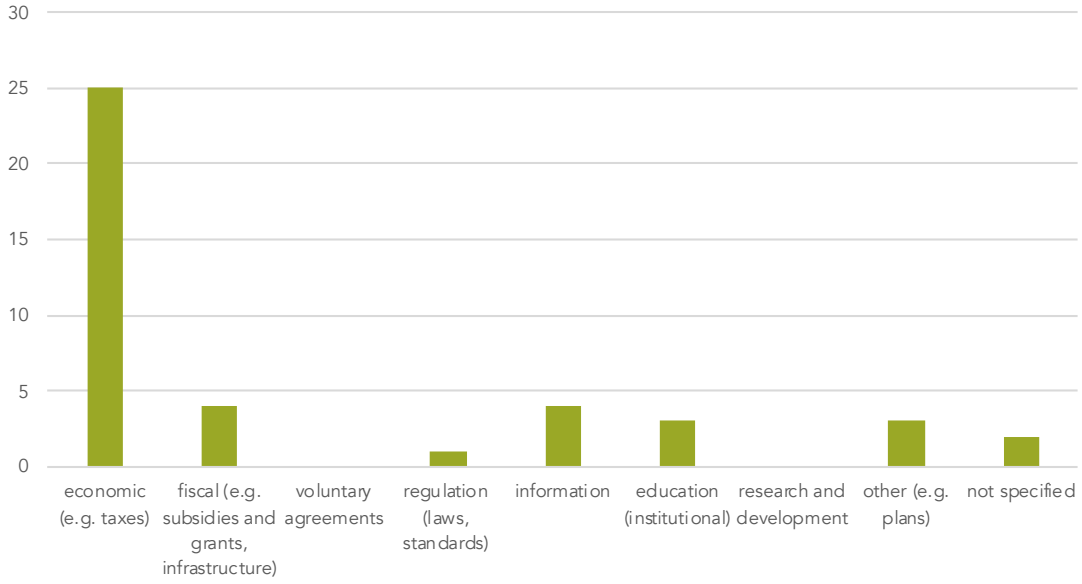

Figure 3. Instrument types of cross-sectoral sufficiency measures.

- Reduction of km: Less common are measures aimed at reducing traffic. Here, the reduction is often also fiscally incentivised, e.g., avoiding trips/flights through a strengthening of server infrastructure, modern videoconferencing systems (Bundesministerium für Wirtschaft und Energie 2020, p. 91; Bundesministerium Nachhaltigkeit und Tourismus 2019a, p. 54; Bundesministerium Nachhaltigkeit und Tourismus 2019b, p. 111). Estonia plans to reduce the need for motorised traffic and dependence on personal cars through well-integrated planning of settlements and transport management (Estonia 2017, p. 3).

In the transport sector, we find that policies rely largely on fiscal and economic incentives/measures, supported in some cases by other instrument types like plans. This makes sense in principle as the precondition for any modal shift or reduction in transport demand a) needs the respective available infrastructure and b) the right cost incentive framework (taxation structure). It is striking, however, that regulation is relatively little applied. To reiterate, this research only counts the number of measures without evaluating their effectiveness.

Overall, the ambition of the identified policies are intended only to meet the current -40 % EU target (the assessment of the European Commission (EC 2020a) which states that NECPs of all countries will lead to a reduction of greenhouse gas emissions of 41 % in 2030 compared to 1990). The higher ambition needed to reach the targets of the Paris Agreement cannot be reached with the implementation of measures currently planned. Additional measures are required.

ADDITIONAL CROSS-SECTORAL MEASURES SUPPORT SUFFICIENCY MEASURES

In addition to the dedicated transport policies, official NECP and LTS documents name a number of cross-sectoral policies that are geared towards a decarbonisation of all or several sec-

tors. As those policies also affect the transport sector, we included them separately into the analysis.

We find a total of 41 such cross-sectoral measures in 23 of the 27 EU member states. These cross-sectoral instruments that member states implemented or plan to implement include mostly economic instruments: all kinds of carbon taxation or emission-driven tax reforms, reduction of climate-harmful subsidies or tax incentives for climate-friendly technologies. These measures account for 60 % of all cross-sectoral policies. The fiscal measures relate to the reduction of environmentally damaging subsidies, informational and educational measures include general cross-sectoral campaigns and inclusion in curricula of content on climate-friendly lifestyles, behaviour and investment.

AN EMERGING PATTERN: LESS MOTORISED INDIVIDUAL TRANSPORT – BUT HOW?

Generally, many economic and fiscal instruments may foster sufficiency in transport. As stated above, this seems sensible because this is very much about infrastructure (enabling a mode shift) and incentivising decisions to use other modes (using taxation instruments). It seems striking that cross-sectoral measures apply mostly economic instruments, which are overwhelmingly carbon taxes or climate-sensitive tax reforms. Those are complemented by few information and education instruments.

The limited focus on reducing transport volumes raises concern as, historically, all efficiency improvements have been undermined by growing transport volumes and other growth-in-size factors. A transformation to a net-zero GHG emission system without regulation seems hardly imaginable: A restriction of ever-growing car sizes and weights, a shift from fossil fuels to renewables, a reduction of person and transport km will need stringent governance. Examples of existing policies include fleet emission limits, phase-out of combustion engines, speed limits and city drive-in restrictions. Future regulations might include an obligation to localities to ensure public transport anywhere with a certain frequency (e.g. half-hourly), car size/weight standards and/or absolute consumption limits, stricter speed limits and city access restrictions as well as fossil fuel phase-outs.

We found 18 measures that directly target car or airplane use and make it more unattractive or expensive (through less parking spaces, access limitations of combustion engines to city centres, speed limits, a special tax on fuel or plane trips) in contrast to 80 measures that directly address modal shift and 26 measures that address a reduction of km in the transport sector. In addition, there are 41 cross-sectoral measures aimed at changing the relative attractiveness of lower-emission transport means. To date, the sufficiency-related strategies appear very cautious and there are few measures openly attacking motorised individual transport.

Although modal shift is key for a net-zero emissions transformation, and many measures partly aim at this, it seems impossible to achieve significant shifts with only the current set of measures. To a very large extent, those measures are mid-term pull-strategies to make less emission-intensive modes more attractive and to a small extent push-strategies to make the polluting ones less attractive, but these are not adequate to achieve the required transformation of the whole transport sector. There is a need for more structural changes making the less polluting alternative the more attractive one. However, fundamental changes like privileging public, shared and non-motorised transport instead of individual motorised transport provide a positive effect for wider society only in the mid- to long-term, which means they are a challenge to implement in a democratic system with short-term election cycles. The following guiding questions can be helpful for policy design:

- What makes people drive more/less?
- Why do people buy a car?
- Why do people choose one mode over another?

Policy makers can directly or indirectly influence the following factors:

- Availability, accessibility of close-by "Points-of-Interest" for daily life (care, health, food etc),
- Work-life location, tele-/home-working, private trips lifestyles,

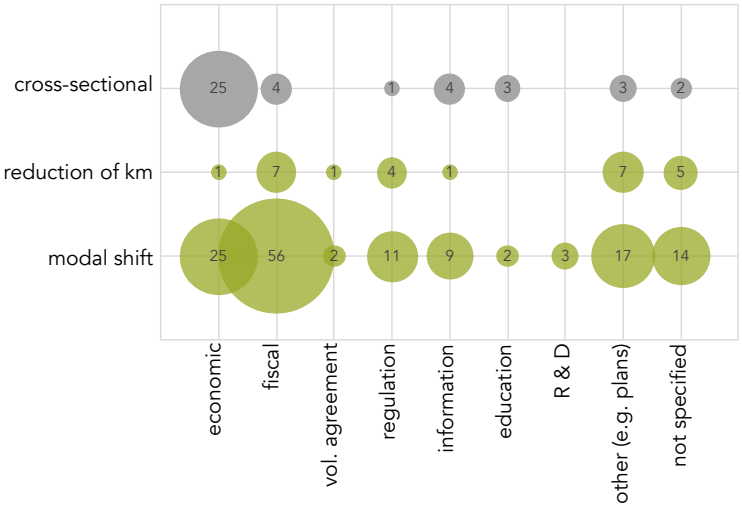

Figure 4. Number of sufficiency policy measures by sufficiency type and instrument type.

- Social contexts, significance, routines ("cars as normality"),
- Mode choice: Easiness of choice, available infrastructures, relative travel time, mobility-as-a-service, frequency, costs, comfort …

Discussion

Although we have not directly compared the number of consistency and efficiency measures to the sufficiency measures found in the LTSs and NECPs, it is obvious that a reduction in demand levels (avoid) is still underrepresented in the political debate despite its potential. Accordingly, a political and scientific debate on how to achieve this is also missing as well as a clear analysis of the direct and indirect effects on the health and quality of life of a structurally different transport system. However, the transport sector is outstanding in terms of the amount of measures being tried compared to the other sectors. This can be explained by the breadth of the challenge in terms of decarbonizing this sector – it is even more apparent than in other sectors that the goal cannot be reached without structural changes enabling different behaviours.

Currently, transport infrastructure planning greatly looks at the needs and wants of private car users and current city planning rather strengthens the need for private cars by inducing long distances to basic needs. Also in many different jurisdictions, owning a car and driving long distances is supported. Thus, a mind-shift to de-privilege private motorised mobility is required and needs to be implemented in transport infrastructure planning, city planning, tax laws etc. The high share of sufficiency measures in the transport sector can be furthermore explained by its characteristics: Mode choice plays a pivotal role in mobility and seems to be the predominant policy option. Moreover, as the state has a key role in the transport sector because it finances most key infrastructure, this role can also be played when designing mobility systems that are less dominated by cars. The use of taxation and fiscal elements can already be observed. However, the level of ambition seems still low relative to the challenge.

In general, we have observed a tendency of policies to support a shift away from the car. This could mark the start of a historical paradigm shift away from the private car being the transport means that infrastructure is predominantly built for and laws are made for. The entire set of measures found, however, are in total only small steps towards reaching the goals of the Paris Agreement. In order to actually reduce car use, measures to promote climate-friendly modes need to be supported by measures that first make adequate alternatives available and then clearly restrict the ownership and use of private cars. One of the few examples mentioning such ambition for structural changes is Estonia's plan to reduce the need for motorised traffic and dependence on personal cars through well-integrated planning of settlements and transport management. Such ambitions need to be strengthened and backed by concrete measures. These are to a large extent missing in the NECPs. However, the measures found could be a first sign of the required mindset and policy shifts needed to reduce transport demand and shifting the primary focus from cars to sustainable mobility.

These small signs of change are even smaller in the freight transport sector, where we could not detect measures to reduce the need for freight transport in the reports.

Further research is required in the direct comparison of efficiency, consistency and sufficiency measures including their (quantitative) effects in terms of emission reduction. The difficulty in detecting sufficiency measures stems from the structure the NECPs have to follow. While renewables and efficiency have their own dedicated chapters, a chapter on sufficiency/avoid measures is lacking in the template of the EU.

Conclusions

Fundamental changes in transport structures and behaviours are required to reach the climate targets of the Paris Agreement. This change will not happen through a mass public mind shift but needs an integrated mix of policy measures from different policy fields to provide a coherent framework.

Sufficiency policy in the transport sector is present in NECPs and LTSs, but the share of measures targeting a reduction in individual and freight kilometres is strongly underrepresented despite its central importance in terms of reaching climate goals. This underrepresentation could be tackled by a separate chapter focusing on a reduction of service demand/sufficiency next to efficiency and consistency chapters in the EU template for NECPs that would force member states to draw-up and plan such policies. As part of the preparation of the NECPs and climate policy in general, policy fields other than those directly related to energy must also be consulted and asked to contribute policies to reduce energy demand in their policy areas. This is necessary because we need more structural changes than those mentioned in the NECPs and LTSs to reach the climate targets of the Paris Agreement.

At the EU policy level, debates on the potential of, and options for, a sufficiency policy could be initiated within the Effort Sharing legislation and the establishment of a Concerted Action (CA) on sufficiency.

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