Decarbonising the transportation sector

Policy options, synergies and institutions to deliver on a low-carbon stabilisation pathway

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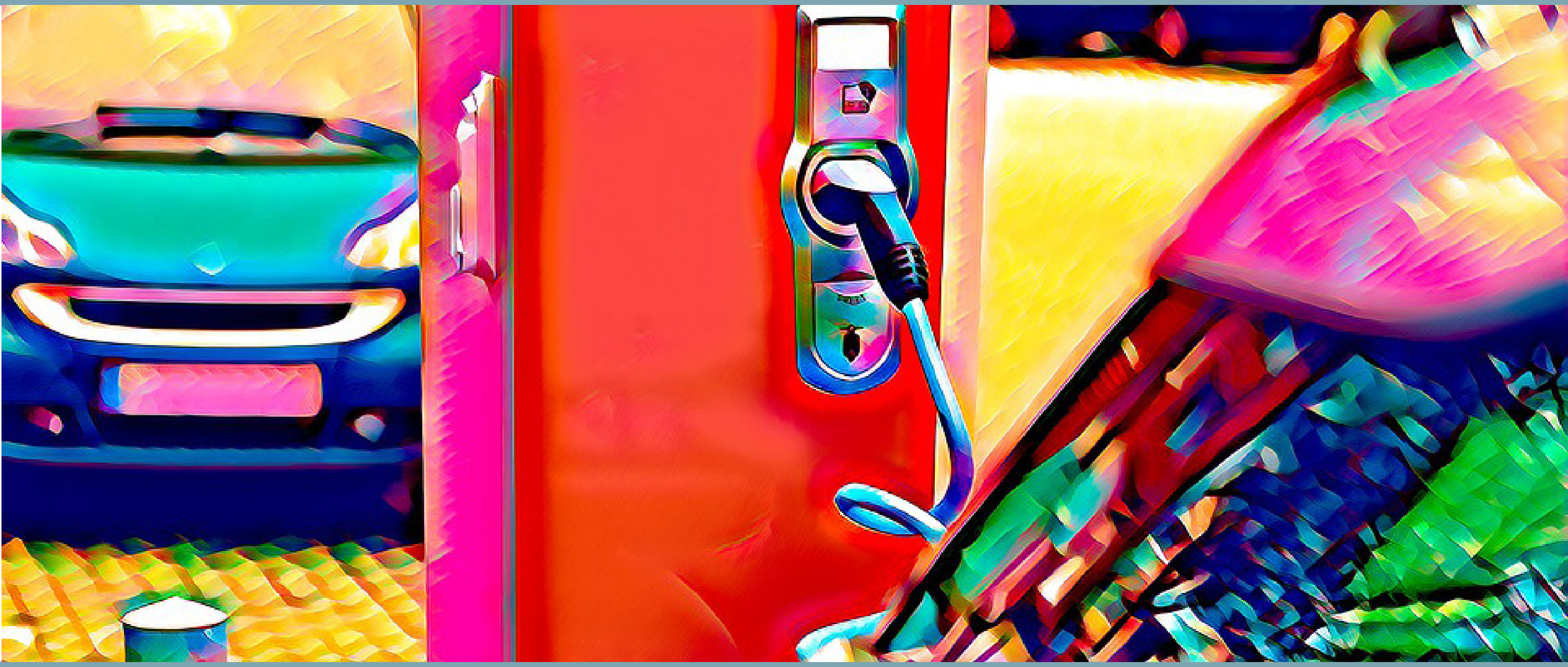

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UEMI

Urban Electric Mobility Initiative (UEMI) was initiated by UN-Habitat and the SOLUTIONS project and launched at the UN Climate Summit in September 2014 in New York.

UEMI aims to help phasing out conventionally fueled vehicles and increase the share of electric vehicles (2-,3- and 4-wheelers) in the total volume of individual motorized transport in cities to at least 30% by 2030. The UEMI is an active partnership that aims to track international action in the area of electric mobility and initiates local actions. The UEMI delivers tools and guidelines, generates synergies between e-mobility programmes and supports local implementation actions in Africa, Asia, Europe and Latin America.

Future Radar

The FUTURE-RADAR project will support the European Technology Platform ERTRAC (the European Road Transport Research Advisory Council) and the European Green Vehicle Initiative PPP to create and implement the needed research and innovation strategies for a sustainable and competitive European road transport system. Linking all relevant stakeholders FUTURE-RADAR will provide the consensus-based plans and roadmaps addressing the key societal, environmental, economic and technological challenges in areas such as road transport safety, urban mobility, long distance freight transport, automated road transport, global competitiveness and all issues related to energy and environment. FUTURE-RADAR will also facilitate exchange between cities in Europa, Asia and Latin America on urban electric mobility solutions. The FUTURE-RADAR activities include project monitoring, strategic research agendas, international assessments and recommendations for innovation deployment as well as twinning of international projects and comprehensive dissemination and awareness activities. Overall it can be stated that FUTURE-RADAR provides the best opportunity to maintain, strengthen and widen the activities to further develop the multi-stakeholder road transport research area, for the high-quality research of societal and industrial relevance in Europe.

Abstract

Abstract

This paper outlines the key elements of a low-carbon stabilization pathway for land transport, focusing on the potential of key policy measures at the local and national level, opportunities for synergies of sustainable development and climate change objectives and governance and institutional issues affecting the implementation of measures. This paper combines several approaches to provide an integrated view on the decarbonisation of the transport sector based on recent literature. The paper will assess the quantitative basis potential climate change mitigation pathways and will then look into policy and institutional aspects that relate to the feasibility of these pathways. This combination of quantitative and qualitative analysis to measure the potential, options and feasibility of climate change mitigation strategies in the transport sector aims to synthesise recent papers on the subject and draw conclusions for future research.

Introduction

Transport plays a key role in delivering on the Paris Agreement, the Sustainable Development Goals and the New Urban Agenda. While providing essential services to society and economy, transport is also an important part of the economy and it is at the core of a number of major sustainability challenges, in particular climate change, air quality, safety, energy security and efficiency in the use of resources. This paper will summarise recent literature on land transport climate change mitigation actions at the local and national level, opportunities for synergies of sustainable development and climate change objectives and governance and institutional issues affecting the implementation of measures.

Considering the fact, that there is an enormous potential to reduce transport sector greenhouse gas emissions cost-effectively and that some countries have shown success in this already, there needs to be an explanation beyond the economic and technical feasibility, there needs to be a political and institutional explanation to the differing progress of countries in this area. Identifying institutional barriers in the in the take-up process of low-carbon transport measures, is not only relevant for OECD countries where emissions from this sector need to be reduced drastically and action needs to start now, but is also particularly relevant for emerging economies where rapid growth and infrastructure development can create a lock-in into a high-carbon energy and transport pathway that will make a 1.5 Degree Celsius stabilisation scenario very unlikely. This analysis aims to explore the political feasibility of the implementation of a comprehensive strategy to decarbonise the transport sector, focusing on major industrialised and emerging economies, which will provide insights on the prospects of decarbonising the sector.

The analysis presented in this paper suggests that there are two factors, which are vital for success for sustainable transport policies:

- An integrated policy approach that combines various measures to provide a basis for political coalitions, and
- political continuity that enables take-up of policies and ensures stability.

The combination of economic, and environmental policy objectives make the transport sector a particularly interesting case for of climate change policies. Transport energy efficiency polices will be used as an example to examine, in more detail, the differences in policy making in different institutional frameworks.

Introduction

This paper will combine several approaches to provide an integrated view on the decarbonisation of the transport sector based on recent literature, which will be validated with interviews with experts and pratitioners from developed and emerging economies. The paper will assess the quantitative basis potential climate change mitigation pathways and will then look into policy and institutional aspects that relate to the feasibility of these pathways. This combination of quantitative and qualitative analysis to measure the potential, options and feasibility of climate change mitigation strategies in a particular sector aims to synthesise recent papers on the subject and draw conclusions for future research. Literature on institutional concepts from political science literature will be complemented by interviews with policy practitioners to provide insights into the policy environment of climate change mitigation measures in the transport sector.

Climate Change Policies

CLIMATE CHANGE POLICIES, CO-BENEFITS AND COALITIONS TO DECARBONISE THE TRANPORT SECTOR

Transport is a complex and multifaceted activity. Policy interventions in this sector can have unintended consequences, positive and negative as they rarely only affect one objective, for example air quality measures may affect fuel efficiency negatively or biofuels may have land-use change implications. Linking and packaging policies is therefore vital to generate synergies and co-benefits between measures. This provides a basis for coalitions that can align different veto players. While some analysis on policy integration has been carried out, e.g. Justen et al. 2014; Givoni 2014, the linkages between policy packaging, co-benefits and coalitions have not been assessed for climate change mitigation strategies in a specific sector yet.

There has been extensive work on institutional structures and characteristics of different forms of government (Lijphart 2012; Tsebelis 2000; Jahn 2014) almost all of which is focusing on democracies in industrialised countries. Some analysis has been carried out to create the link between institutions and environmental performance (Scruggs 1999; Lundqvist 1980; Jordan, Wurzel, and Zito 2013; Wurzel 2010) again focusing on industrialised countries and not being sector specific. This is where this paper aims to add value, by making a clear case for the mitigation potential in one specific sector, pointing at specific policies and their potential for coalition building and comparing this to the institutional structures in developed and emerging countries.

To identify the potential contribution of policy integration and governance factors on a low-carbon, sustainable development pathway in the transport sector, three aspects will need to be examined:

- Trends and drivers: What are the key trends and drivers in the transport sector, what is the greenhouse gas emission reduction potential and how can mitigation pathways contribute to sustainable development as lever for broad coalitions?
- Potential for co-benefits: What policies are needed to achieve a sustainable, low-carbon pathway for transport, what barriers have to be overcome and how would a integrated policy strategy need to be designed to provide a basis for political coalitions?
- Coalitions and institutions: What institutional framework creates sufficient political stability and continuity to foster the take-up of and long-term support for sustainable transport strategies?

2.1 Trends and drivers

The transport sector is currently on track to continue to stay at current levels of greenhouse gas emissions even under very optimistic scenarios (Fulton, Lah, and Cuenot 2013; Harvey 2013). Growth in mobility demand for mobility outpaces efficiency gains. Even when taking into consideration a substantial take-up of more efficient vehicles technology and some modal shifts, transport CO2 emissions in 2050 will still be at 2015 levels of around 7.5 Giga-tonnes of CO2 (ITF 2017). If, however, there are now changes to current trends, transport sector greenhouse gas emissions are set to double by 2050 (IPCC 2014). Setting the transport sector on a low-carbon development pathway is essential for global climate change mitigation efforts that aim to stabilise global warming at well below 2C, which is the internationally agreed target under the United Nations Framework Conventions on Climate Change (UNFCCC). To contribute to this target developed countries will have to rapidly decarbonise their transport sector over the coming decades (-80% by 2050) and developing and emerging countries will have to curb growth (+70% by 2050), which will require substantial policy action (ITF 2017). More analysis is still needed to create a better understanding of the difference of 2C and 1.5C mitigation pathways for various sectors including transport, which will be the task for an upcoming IPCC Special Report.

The main message of the body of scientific literature on decarbonisation scenarios has not change substantively since the strengthened Paris Agreement targets were adopted (Creutzig 2016). However, the analysis of Nationally Determined Contributions (NDCs) carried out by a number of authors shows that there is a substantial gap between the mitigation action needed

Trends and drivers

and the proposed policy actions by countries (Cooper 2016; Antimiani et al. 2016; Zhang and Pan, 2016; Cassen and Gracceva 2016). Recent analysis shows that urban passenger transport and surface freight transport need to play a major role in decarbonising the sector, both in managing growth in emerging economies and drastically reduce emissions in industrialised economies, even more so when aiming for a 1.5C stabilisation pathway.

Urban passenger transport plays also a particularly important role in providing access to urban services, economic opportunities and social participation (Bibas, Méjean, and Hamdi-Cherif 2015; Admasu, Balcha, and Getahun 2016; Angel and Blei 2016). Car, but also bus travel is projected to increased rapidly in developing and emerging economies. This reflects the growing travel demand in developing economies, which is a vital component of economic development (Berry et al. 2016; Gschwender, Jara-Díaz, and Bravo 2016; Spyra and Salmhofer 2016).

Several international assessments have technological potential and effort reqired to decarbonise the transport sector (IPCC 2014; Dessens, Anandarajah, and Gambhir 2016; Figueroa Meza et al. 2014; Fulton, Lah, and Cuenot 2013). These analyses show that, moving on to a stablisaton pathway that is consistent with global climate change targets, transport needs to decarbonize substantially over the coming decades and almost entirely in industrialised countries by the middler of this century (IEA 2016, ITF 2017). Taking this path will unlock direct and indirect benefits that outweigh the costs, with savings of between USD 50 trillion and 100 in trillion in fuel savings, reduced vehicle purchases, needed infrastructure and fuel costs (IEA 2014, 2016). The additional co-benefits and synergies generated by sustainable mobility, such as improved safety and air quality and reduced travel time make an even stronger case for the shift towards low-carbon transport. The contribution of contries to the global decarbonisation efforts of the (land-) transport sector is reflected in several studies that show travel demand, technology deployment and policy interventios and their effect on different scenarios.

From a climate change perspective vehicle technology and fuel switch options provide the biggest mitigation potential (Kahn Ribeiro and Figueroa 2012). However, this does not fully reflect a broader sustainable mobility perspective. A broader multimodal approach that manages growth in travel demand and modal split may yield important benefits in air quality, traffic congestion, safety and overall societal mobility may trigger substantially higher socio-economic co-benefits and may also be more cost effective (van Vuuren et

al. 2015).
The mitigation potential of a number of transport sector mitigation measures has been well-established, e.g., shift to public and non-motorized transport and efficiency improvements of internal combustion engines (Sims et al. 2014; Kok, Annema, and van Wee 2011; Wright, L., Fulton 2005). However, a more integrated view that combines technology shifts potential in a balanced perspective to the wider sustainable (urban) development approach of low-carbon mobility options still needs further research (Saujot and Lefèvre 2016; Creutzig 2016).
Only a few high-level climate change mitigation potential assessments manage to show the relationship between the fuels, and technology elements and the planning, and model shift aspects of a decarbonisation pathways for transport (Sims et al. 2014; Figueroa Meza et al. 2014; Fulton, Lah, and Cuenot 2013). However, there are a number of case studies that provide indications of induvial experiences on costs and benefits of specific measures, which will be explored in the following section.
The main message from decarbonisation scenarios is that light-duty vehicle (LDV) travel will need to change rapidly in industrialised countries and shift towards more efficient vehicles technologies and more efficient modes of transport. In industrialised economies a reduction of car travel between 4 to 37% combined with average vehicle fuel efficiency (reduction in energy/km) of between 45 to 56% would be required to achieve the desired reduction of 73-80% to be roughly in line with an emission reduction pathway for a 2°C stabilization scenario as suggested by the IPCC (IEA 2016; Fulton, Lah, and Cuenot 2013). In developing and emerging countries, light-vehicle travel per capita has still a potential to grow even under a low-carbon development scenario by around 130 to 350 % if accompanied by fuel efficiency and carbon intensity gains of 40 to 50% (IEA 2016; Fulton, Lah, and Cuenot 2013).

2.2 Potential for co-benefits

It is often claimed that transport is one of the hardest sector to decarbonise (Vale 2016; Cai et al. 2015; van Vuuren et al. 2015). This view is challenged by a number of more recent papers, which show that an integrated policy approach can address create co-benefits with other key policy objectives, such as health, productivity, energy security and safety, which can lead to a maximum of socio-economic benefits (Bollen 2015; Dhar and Shukla 2015; Lah 2015; Schwanitz et al. 2015; Dhar, Pathak, and Shukla 2017). These synergies between policy objectives have the potential

Potential for co-benefits

to incorporate the positions of relevant veto players, which can help forming coalitions to support policy implementation (Lah 2017).

If applied in isolation policy measures are unlikely to achieve goals without generating trade-offs that create a risk of a veto player blocking the implementation process. For example, increased fuel taxes, without the provision of modal alternatives and measures to ensure a supply of efficient vehicles, would impact negatively on mobility and transport affordability (Greene, D.L., Patterson, P.D., Singh, M., Li 2005; Sterner 2007), which would result in relevant veto players blocking this initiative. However, a balanced and integrated policy approach combines measures such as vehicle efficiency standards, fuel tax, differentiated vehicle taxes with the provision of modal choices and compact city design, has the potential of addressing policy objectives that can ensure relevant veto players support the implementation.

Several papers assess the emission reduction potential of measures will be quantified in this paper and the benefits of measure combination highlighted (Table 1). This provides the basis for an analysis of the potential for synergies and co-benefits generated by an integrated policy approach for coalitions among key veto players in the following section. Table 1 provides an overview of the required policy interventions, their potential impact and co-benefits, which gives an indication of the key policy actors involved and with that the potential veto players (Lah 2017a).

Table 1. Greenhouse gas mitigation potential and co-benefits potential

Coalitions and institutions

2.3 Coalitions and institutions

Energy and climate change policies for the transport sector generally require a consensus on the need for policy intervention and a strategic, coherent, and stable operating environment. Policy interventions in the transport sector, such as fuel and vehicle taxation, are highly visible and politically sensitive. They require a strong political commitment to appear on the policy agenda and to remain in place as they rely on investments that are only cost-effective over the medium to long-term (IEA 2010; IPCC 2014). Developing consensus can be difficult because transport is complex and multifaceted and policy interventions can have unintended consequences (Lijphard 1984; Klenk and Meehan 2015; Häussler et al. 2016). Linking and packaging policies is vital to generate synergies and co-benefits between measures, including linking GHG reduction goals with other sustainable development goals, such as increasing energy security, road safety, public health, increasing economic productivity and air pollution, and improving equity and access (Kanda, Sakao, and Hjelm 2016; Wen et al. 2016). A survey and interviews carried out for this paper among local and national policy advisors in Europe, Asia, Africa and the Americas shows that the lack of funds, lack of suitable technologies and also public opposition are not considered to be the main barriers for the take-up of sustainable transport measures. The largest barriers for the sustainable transport policy action are insufficient knowledge of the various benefits of sustainable mobility, in particular among political decision makers and institutional barriers that directly affect the implementation process (Figure 1). Knowledge about the potential co-benefits of sustainable transport policy can help aligning different policy actors and institutions.

An integrated policy approach that creates consensus and coalitions among diverse stakeholders and interests can help to overcome implementation barriers, minimize rebound effects, and motivate people, businesses, and communities (von Stechow et al. 2015). This type of integrated policy approach is especially critical because current GHG reduction measures alone can make important contributions but cannot achieve the levels of reduction needed to shift to a 1.5°C pathway (IPCC 2014).

Decision making on transport policy and infrastructure investments is as complex as the sector itself. Rarely will a single measure achieve comprehensive climate change impacts and also generate economic, social and environmental benefits (Lah 2014; Creutzig 2016). Many policy and planning decisions have synergistic effects, meaning that their impacts are larger if implemented together. It is therefore generally best to implement and evaluate integrated programs rather than individual strategies (Hüging, Glensor, and Lah 2014). For example, by itself a public transit improvement may cause minimal reductions in individual motorized travel, and associated benefits such as congestion reductions, consumer savings and reduced pollution emissions. However, the same measure may prove very effective and beneficial if implemented with complementary incentives, such as efficient road and parking pricing, so travellers have an incentive to shift away from individual car travel(Cuenot, Fulton, and Staub 2012; den Boer et al. 2011). In fact, the most effective programs tend to include a combination of qualitative improvements to alternative modes (walking, cycling and public transit services), incentives to discourage carbon-intensive modes (e.g. fuel pricing, vehicle fuel efficiency regulation and taxation), and integrated transport and land use planning, which

Figure 1 Barriers for sustainable mobility policy implementation

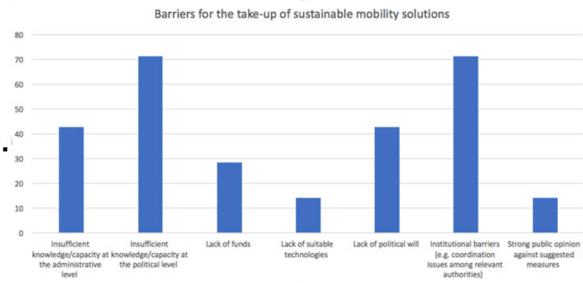

Figure 1 Barriers for sustainable mobility policy implementation

creates more compact, mixed and better connected communities with less need to travel (Figueroa Meza et al. 2014; Sims et al. 2014).

A vital benefit of the combination of measures is the ability of integrated packages to deliver synergies and minimise rebound effects. For example, the introduction of fuel efficiency standards for light duty vehicles may improve the efficiency of the overall fleet, but may also induce additional travel as fuel costs decrease for the individual users (Yang et al. 2017). This effect refers to the tendency for total demand for energy decrease less than expected after efficiency improvements are introduced, due to the resultant decrease in the cost of energy services (Sorrell 2010; Gillingham et al. 2013, Lah 2014). Ignoring or underestimating this effect whilst planning policies may lead to inaccurate forecasts and unrealistic expectations of the outcomes, which, in turn, lead to significant errors in the calculations of policies' payback periods (IPCC 2014). The expected rebound effect is around 0-12% for household appliances such as fridges and washing machines and lighting, while it is up to 20% in industrial processes and 12-32% for road transport (IEA 2013). The higher the potential rebound effect and also the wider the range of possible take-back, the greater the uncertainty of a policy's cost effectiveness and its effect upon energy efficiency (Ruzzenenti and Basosi 2008).

The current approach to transport policy and infrastructure appraisal that does not take fully into account the wider socio-economic benefits of sustainability mobility (Hüging, Glensor, and Lah 2014). A number of studies emphasize that an integrated approach is vital to reduce transport-sector greenhouse gas emissions cost-effectively (IPCC 2014, Figueroa Meza et al. 2014). While emissions reductions can be achieved through several means, such as modal shift, efficiency gains and reduced transport activity, it is apparent that the combination of measures is a key success factor to maximise synergies and reduce rebound effects. For example, overall travel demand reduction and modal shifts would need to be substantially stronger if not accompanied by efficiency improvements within the vehicle fleet and vice-versa (Figueroa Meza et al. 2014; Fulton, Lah, and Cuenot 2013). Vital element for this strategy is a policy package as summarised in Table 2 below.

Table 2: Elements of a multi-modal, multi-level sustainable transport package

Policy continuity and consensus - Policy agenda setting and policy continuity is affected by political consensus, which is a result of political and institutional relationships (Fankhauser, Gennaioli, and Collins 2015; Marquardt 2017). These relationships, including the interactions between different levels of government (e.g. local, state, federal, supra-national) and acknowledgment of scientific consensus on climate change policy, vary greatly between key political and societal actors (Never and Betz 2014). Political environments vary by country and change over time, which affects implementation of sustainable transport and other climate change mitigation measures and results in significant differences between countries' progress reducing GHG emissions from the transport sector. Changing political environments means that policy environments are also influenced by a level of political volatility. Hence, a shared set of methods and values are generally considered vital for setting the policy agenda, usually delivered through knowledge communities. Support from diverse political and public stakeholders is vital for the long-term success of policy and infrastructure decisions. This support can often be tied to the level of trust between stakeholders and policy makers, and the role that facts play in the decision-making process (Simmons 2016; Freitag and Ackermann 2016). Public perception and the influence of epistemic communities also plays an important role for the political agenda setting and consensus on major policy issues such as climate change and energy efficiency (Hagen, Middel, and Pijawka 2016; Cook and Rinfret 2015).

Policy integration and coalition building - The policy environment, or context in which decisions are made, is as important as the combination of policy decisions and infrastructure investments that make up a low-carbon transport strategy (Justen et al. 2014). This policy environment includes socio-economic and political aspects of the institutional structures of countries. These structures help build coalitions, but can also increase the risk that a policy package fails because one measure faces strong opposition (Sørensen et al. 2014). A core element of success is the involvement at an early stage of potential veto players and the incorporation of their policy objectives in the agenda setting (Tsebelis and Garrett 1996).

Institutional context - The political and institutional context in which policies are pursued is a factor to be considered for the success or failure of implementation (Jänicke 1992). Institutional aspects, such as the presence/absence of an environment ministry at the national level or environment department on the local level, and their respective roles in the process are likely to have an effect on the implementation of (primarily) climate related transport measures (Fredriksson, Sauquet, and Wollscheid 2016). The legal power, budget and political influence of these agencies are equally important (Jänicke 2002).

Discussion

Provided that technologies to reduce greenhouse gas emissions are available and policy mechanisms to support the uptake of these technologies are proven to be effective the factors that influence the policy environment in which transport energy efficiency policies can be successful over the long-term are the vital aspect that enables the take-up of technologies and policies.

Energy and climate change policies for the transport sector require a stable political operating environment to enable long-term investment decisions by industry and consumers (Lakshmanan 2011; Fais, Sabio, and Strachan 2016; Spataru et al. 2015). Consensus focused governance and institutional structures may be able to provide such a strategic, coherent and stable operating environment. Policies to reduce energy consumption in the transport sector require a strong political commitment to appear on the policy agenda and to remain in place as they rely on investments that are only cost-effective over the medium to long-term (ITF 2017). Policy interventions in the transport sector, such as fuel and vehicle taxation, are highly visible and politically sensitive. To get a clearer picture of the feasibility of climate policy pathway one can draw on well-established concepts from the political science theory that aim to identify key institutional characteristics that influence policy processes. For example, there are a number of studies examining the influence of the concepts of institutions and actors within the policy process (for example: Haas 1992, 1999; Jahn 1998; Scruggs 1999, 2001; Jänicke 2002; Tsebelis 2002; Neumayer 2003; Bernauer & Koubi, 2009). Most of these studies focus on higher level environmental performance indicators (e.g. Lundquist 1980; Scruggs 1999, 2001; Congleton, 1992; Jahn 1998, Jacob and Volkery 2004). Considering the in complexity of policy making processes it is challenging to draw direct conclusions from institutional settings to climate policy performance. However, several recent studies highlight the relevance of the veto player concept for domestic and international environmental policy (Jahn 2014; Batalla 2012; Schulze 2014; Singh and Dunn 2013; Sotirov and Memmler 2012). Similarly, recent papers continue to assess the role of corporatist structures in environmental policy (Cairney 2014; Iguchi 2015; Jones 2014; Vink et al. 2015; Weiner 2014; Benoit and Patsias 2014).

The relationship between institutional structures and climate policy performance becomes obvious when assessing the stability (or the lack thereof) of specific policies in different countries. After the 2016 presidential elections, climate change policies in the United States are taking a radical U-turn, which highlights the political volatility that is a key institutional feature of majoritarian democracies that rely almost entirely on the minimal coalition and partisan support, rather than a broad societal consensus on climate policy that features very prominently in the European Union and its member states. To establish a relationship between institutional structures and capacities, and climate policy impacts, i.e. emission reductions, it is first vital to establish the link between a certain set of policies and their ability to deliver substantial emission reduction impacts. A review of key policy measures in G20 countries focused on improving the efficiency of the light-duty vehicle (LDV) fleet shows that only a combination of vehicle fuel efficiency standards along with vehicle and fuel taxation delivers significant improvements in the efficiency of the vehicles fleet and in-use efficiency gains (Yang et al. 2017). These national policy level measures are a vital backbone of a comprehensive policy package. When correlating these measures with institutional features of consensus democracies a first indication of a positive relationship between the presence of institutions that enable a stable and consensus oriented policy environment and the presence of key national level policy measures can be derived (Lah 2017b). This is then further substantiated by interviews with policy advisors and practitioners (Figure 2) who confirm that the reliance on particular political parties may deliver swift and more ambitious immediate policy action, which may, however, be overturned after elections as for example the announcement by the new US administration to weaken the vehicle fuel efficiency standards and regulations. The risk of political volatility is also reflected in Figure 2, where only 20% of the respondents consider it feasible that political parties can find common ground on sustainable transport issues and that policies are often implemented in an isolated way. However, relevant authorities at the local and national level are considered more prone to cooperate with counterparts on sustainable transport policy.

Figure 2 Factors of governance and policy integration affecting the implementation of sustainable mobility measures

Institutional structures, policy continuity and implementation are vital aspects to deliver of global climate change goals in line with the Paris Agreement. The decarbonization pathways across sectors are clearly outlined (IPCC 2014) and translated to actions in the transport sector, highlighting the fact that global climate change mitigation targets will not be reached without an appropriate contribution by the transport sector (Fulton et al. 2013, Sims 2014). The climate change mitigation potential of specific measures has been well-established, showing that the technological change to reduce transport sector greenhouse gas emissions is readily available (Figueroa et al. 2014). An integrated policy approach that aims to generate synergies (rather than trade-offs) between policy objectives can help to maximise socio-economic benefits and can help to form coalitions that endure and are resilient in the face of political volatility (Table 3).

Table 3 Pathways, policy and governance approaches for low-carbon transport

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