



NDC ASPECTS

On the Road to Somewhere? Assessing Climate Governance Gaps and Options for the Land Transport Sector (Deliverable 6.1d)

WP6 – Global Governance and International Cooperation

24.10.2022

Catherine Hall, Harro van Asselt

University of Eastern Finland

Version: 1

October 2022

www.ndc-aspects.eu

Catherine Hall

University of Eastern Finland, Centre for Climate
Change, Energy and Environmental Law

cathhall@uef.fi

<https://sites.uef.fi/cceel/>

Harro van Asselt

University of Eastern Finland, Centre for Climate
Change, Energy and Environmental Law

harro.vanasselt@uef.fi

<https://sites.uef.fi/cceel/>

Disclaimer

The sole responsibility for the content of this publication lies with the authors. It does not necessarily reflect the opinion of the European Union. Neither the CINEA nor the European Commission is responsible for any use that may be made of the information contained therein.

Copyright Message

This report, if not confidential, is licensed under a Creative Commons Attribution 4.0 International License (CC BY 4.0); a copy is available here: <https://creativecommons.org/licenses/by/4.0/>. You are free to share (copy and redistribute the material in any medium or format) and adapt (remix, transform, and build upon the material for any purpose, even commercially) under the following terms: (i) attribution (you must give appropriate credit, provide a link to the license, and indicate if changes were made; you may do so in any reasonable manner, but not in any way that suggests the licensor endorses you or your use); (ii) no additional restrictions (you may not apply legal terms or technological measures that legally restrict others from doing anything the license permits).



NDC ASPECTS project has received funding from
the European Union's Horizon 2020 Research
and Innovation programme under grant
agreement No 101003866

Executive summary

Notwithstanding its overall importance, the United Nations (UN) climate change regime has so far played a limited role in driving sectoral transformations towards climate neutrality. However, the challenges and opportunities for sectoral transformations, as well as the need for and potential of international governance, differ across varying sectoral systems. Land transport is a major emitter of greenhouse gas emissions and one of the most difficult sectors to decarbonise. Emissions from the land transport sector are projected to rise, with total transport activity expected to more than double by 2050 against 2015 levels (International Transport Forum, 2021). Drawing on a review of available policy documents and secondary literature, this paper assesses the extent to which international governance can promote the transformation of land transport towards sustainability and decarbonisation. It first identifies the key challenges and barriers to sectoral decarbonisation in land transport, as well as any unexploited potentials. The paper then examines the potential of international cooperation to address these barriers and mobilise any potentials, mapped against six key governance functions, namely: (1) guidance and signal, (2) rules and standards, (3) transparency and accountability, (4) means of implementation (5) knowledge and learning, and (6) orchestration and coordination. The paper subsequently analyses the existing governance landscape, to identify to what extent current institutions have been exploiting these governance potentials. The paper finds that the overall international governance potential in the area of sustainable mobility remains underexploited. The paper accordingly explores how international governance may be enhanced in the land transport sector and offers some concrete options to this end, including institutional reform as well as the potential creation of a new institution in the form of a climate club.

1 Introduction

Land transport is a significant and rapidly growing emitter of greenhouse gas (GHG) emissions. In 2021, emissions from the transport sector as a whole accounted for roughly 21% of global carbon dioxide (CO₂) emissions (International Energy Agency, 2021). Since 2010, transport-related emissions have also risen faster than in any other end-use sector (Jaramillo et al., 2022). Accordingly, the decarbonisation of land transport will be crucial in realising the long-term goal of the Paris Agreement to keep the global average temperature increase to well below 2°C, with the aim of limiting it to 1.5°C. However, achieving deep emission reductions will necessitate transformative changes to the sector (Jaramillo et al., 2022). In line with current trends, total transport activity is expected to more than double by 2050 compared to 2015 levels (International Transport Forum, 2021). Even against modal shifts and advancements in vehicle efficiency technology, this growth in demand is expected to outpace emission reductions (Lah, 2017), making land transport one of the most daunting sectors for climate change mitigation.

Although the Paris Agreement covers all sectors of the economy, the barriers to the transition towards climate neutrality – as well as the potential of international governance to address these – vary substantially across sectoral systems. To drive sectoral transformations, sector-specific approaches to climate mitigation have been called for (Oberthür, Hermwille and Rayner, 2021). Against this background, this paper aims to analyse the extent to which international governance can promote the transformation of land transport towards sustainability and deep decarbonisation.

Existing literature has identified the potential of sector-specific approaches to international climate governance (e.g. Sawa, 2010; Schmidt et al., 2008; Victor et al., 2019). A recent paper specifically analysed the potential of international climate governance to promote the decarbonisation of land transport (Obergassel, Lah and Rudolph, 2021). Updating and building on this assessment, this paper first summarises existing governance gaps in the sector. In doing so, the paper compares the theoretical potential of international governance against the existing governance supply in the sector. The paper then aims to go beyond existing literature by exploring concrete options to address key governance gaps.

The paper proceeds in four key steps. First, the paper summarises the key transformation barriers to decarbonisation in land transport. Second, the paper discusses the potential of international governance to overcome these barriers, mapped against six governance functions. Third, the paper discusses the extent to which international institutions have already exploited the governance potential identified in the foregoing section. This discussion leads to an identification of existing governance gaps and unexploited potentials. In a final step, the paper explores options for advancing the global governance of land transport and addressing the identified gaps by discussing proposals for the reform of existing institutions, as well as the creation of new institutions.

Methodologically, the paper draws on a review of available policy documents (including outputs from relevant international and transnational institutions), as well as secondary literature.

2 Assessment of existing sectoral governance landscape: gaps and potentials

2.1 Synthesis of main barriers to sectoral decarbonisation

Staying below 1.5°C will require transport-related emission reductions of 70–80% by 2050 compared to 2015 (Jaramillo et al., 2022). The Intergovernmental Panel on Climate Change (IPCC) suggests that this transformation requires a paradigm shift that embeds systemic infrastructure changes to minimise demand, as well as technological changes (Jaramillo et al., 2022). Traditionally, most climate mitigation options focused on technology options, such as vehicle electrification (Creutzig et al., 2018). However, even if all new cars sold were electric, research shows it could take up to 20 years to replace the global fossil-fuel fleet (Keith et al., 2019). Accordingly, if the transport sector is to realise its full mitigation potential, demand management solutions that drive behavioural change – including more compact land-use, and less car-dependent infrastructures that encourage modal shifts, such as cycling and public transport – must be pursued in parallel (Jaramillo et al., 2022; Sims et al, 2014). However, the implementation of both mitigation strategies faces several barriers.

TABLE 1: SUMMARY OF SECTORAL TRANSFORMATION BARRIERS.
BASED ON JARAMILLO ET AL. (2022) AND OBERGASSEL ET AL. (2021).

Type of barrier	Sectoral transformation barriers	
	Managing demand	Electrification
Political/institutional	<ul style="list-style-type: none"> → Carbon intensity of traditional mobility and planning paradigms → Reluctance to implement measures to curb car usage 	<ul style="list-style-type: none"> → Countries locked-in to diesel technologies due to investments made in internal combustion engines
Practical	<ul style="list-style-type: none"> → Significant reconstruction needed to modify infrastructures → Limited capacity, especially in Global South 	<ul style="list-style-type: none"> → Mass roll-out of charging infrastructure → Limited capacity, especially in Global South
Economic	<ul style="list-style-type: none"> → High levels of investment and capital required to establish new infrastructure for sustainable transport 	<ul style="list-style-type: none"> → Higher purchasing costs for electric vehicles → Investments required for charging and grid infrastructure
Technological	<ul style="list-style-type: none"> → Slow adoption of digitised services for seamless travel chains and demand management 	<ul style="list-style-type: none"> → Power generation capacity → Battery performance → Unequal access to charging infrastructure

2.1.1 Institutional and political barriers

Land transport is fundamental to many aspects of modern society. Individual motorised mobility and the expansion of infrastructure is considered crucial in delivering economic growth, consumer services, and overall societal well-being (Oberghassel, Lah and Rudolph, 2021; Sims et al. 2014; Driscoll et al., 2014). Accordingly, there is a general reluctance to implement measures to curb individual motorised usage (Cohen et al., 2016). Instead, policy incentives and planning practices that increase transport demand have been encouraged (Metzler et al., 2018; Piatkowski et al., 2017; Pucher et al., 2007). This presents substantial institutional barriers to decarbonising land transport, which will involve a fundamental rethinking of traditional, carbon-intensive mobility and planning paradigms (Jaramillo et al., 2022; Oberghassel, Lah and Rudolph, 2021; Mattioli et al., 2020).

In addition, investments made in internal combustion engines (ICEs) could mean that countries risk being locked into suboptimal diesel technologies (Roberts, 2022; Oberghassel, Lah and Rudolph, 2021; Skeete, 2017). This presents strong institutional and political barriers to electrification. While various nations have begun formulating favourable policies and incentives for the uptake of electric vehicles (EVs), the political influence of car companies is well demonstrated by the Dieselgate scandal in Europe (see Oberghassel, Wang-Helmreich and Hermwille, 2019).

2.1.2 Practical barriers

In industrialised countries, many urban cities are car-dominated and locked into high levels of transport demand (Jaramillo et al., 2022; Driscoll et al., 2014; Figueroa et al., 2014). To lower this demand, cities will have to undergo significant reconstruction to modify their infrastructure (Oberghassel, Lah and Rudolph, 2021; Gössling et al., 2016). In countries that are in the process of rapid urbanisation, notably throughout the Global South, there is a risk that the same carbon lock-ins will be reproduced (Jaramillo et al., 2022; Oberghassel, Lah and Rudolph, 2021). The ability of these jurisdictions to pursue low-emission pathways may be further hindered by their limited capacities.

These practical barriers differ greatly across countries. Even inside Europe, there are vast disparities. For example, with regard to charging infrastructure, half of all charging points in Europe are located in Norway and Germany alone (European Automobile Manufacturers' Association, 2022). While some countries are taking a clear lead in terms of sustainable infrastructure rollout, the majority are failing to keep up.

2.1.3 Economic barriers

High levels of investment and capital will be required to establish new infrastructure for sustainable transport to manage demand (Jaramillo et al., 2022; Oberghassel, Lah and Rudolph, 2021), particularly in developing nations. As for electrification, EVs have higher purchasing costs than traditional vehicles (Victor et al., 2019). Growth in electromobility also necessitates investments into charging and grid infrastructures (Jaramillo et al., 2022), including the installation of charging equipment at homes and in workspaces (Jaramillo et al., 2022; Hardman et al., 2018).

2.1.4 Technological barriers

Technological barriers are particularly acute in the context of the development of and access to modern EV technology. These challenges will be particularly severe in developing countries, where

public funds and administrative capacities are limited. One example concerns power generation capacity and adaptations to the electricity grid (Jaramillo et al., 2022; Obergassel, Lah and Rudolph, 2021). While some grids will already possess the excess capacity to accommodate an increase in power, other existing infrastructures will not.

A further barrier concerns the performance of EV batteries (Jaramillo et al., 2022). For instance, a study by the American Automobile Association (2019) identified that EV batteries do not perform well in very cold climates. The research confirmed that when temperatures fell to 20 degrees Fahrenheit (about -7 Celsius), the average range of the tested vehicles dropped by 41% (American Automobile Association, 2019). Another barrier to EV technology uptake concerns unequal access to charging infrastructure. Not only is there a clear lack of available charging points, but geographical distribution is also uneven and strongly skewed against rural, lower-income and disadvantaged areas (Hsu and Fingerman, 2021; Competition and Markets Authority, 2021).

In terms of demand management solutions, digitised services for seamless travel chains – such as Mobility as a Service (MaaS) – also face technological barriers. By integrating connected, multi-modal transport systems and promoting a shift away from privately owned cars, digitised services such as MaaS offer a way to reduce demand and hence emissions (Labee et al., 2022). A study by Juniper Research (2018) indicated that the implementation of MaaS platforms could replace up to 2.3 billion private car journeys per year by 2023. However, as a concept that is still in its infancy, digitised services such as MaaS are faced with slow adoption rates (Pangbourne, 2020).

2.2 Potential of international cooperation to address barriers and advance the decarbonisation of land transport

This section discusses how six key governance functions could address the foregoing barriers. These functions form the basis of a conceptual framework to deliberate the potential of international institutions to transform land transport towards decarbonisation. The first five functions are adopted from Oberthür, Hermwille and Rayner (2021). In light of the proliferation of international institutions, this paper introduces a further governance function: orchestration and coordination of existing institutions (Abbott, 2018).

First, international institutions can issue **(1) guidance and signals** to provide states and non-state actors with a certain course of action to pursue, such as decarbonisation visions, targets and pathways. To overcome political and institutional barriers concerning traditional carbon-intensive and car-dominated mobility paradigms, international institutions could create a sector-specific decarbonisation target and roadmap. This could be vital in establishing a legitimate basis to set expectations on both national and local policymakers (Obergassel, Lah and Rudolph, 2021). Given the longevity of traditional mobility paradigms (Mattioli et al., 2020), an international target and roadmap adopted between governments could help promulgate a new paradigm for transport that focuses on managing demand, rather than prioritising the expansion of infrastructure and individual motorised mobility.

Second, international institutions can set **(2) rules and standards** to achieve particular actions or outcomes from members. The creation of international emissions budgets specific to transport could help address political and institutional barriers concerning the carbon-intensity of traditional mobility paradigms, by limiting the quantity of transport-related emissions a country can release. By setting

explicit budgets, states would be tied to quantified expectations to limit their transport-related emissions. Accordingly, states would be under increased pressure to decarbonise their mobility systems, which could in turn promote a shift in attitudes to abandon existing, carbon-intensive paradigms.

To tackle political and institutional barriers concerning lock-ins to diesel technologies, international institutions could also create coordinated phase-out dates for fossil-fuelled vehicles, which many countries have already committed to domestically (Wappelhorst and Cui, 2020). Given that vehicle manufacturing is highly concentrated, international coordination – in the form of an explicit phase-out date for ICE vehicles – between a small number of key manufacturing countries could significantly influence the global automobile market and ultimately dismantle lock-ins (Obergassel, Lah and Rudolph, 2021). In addition, international agreement on carbon pricing agreed between governments could help confront economic barriers concerning higher purchasing costs for EVs, by rendering zero-emission technologies more economically attractive than higher-emission options (Leard, Linn & Cleary, 2020).

Third, international institutions can enhance **(3) transparency and accountability** through reporting, review and compliance mechanisms, to analyse the action of members and address issues of implementation. In addition to providing guidance and setting rules, political and institutional barriers concerning reluctance to abandon traditional carbon-intensive mobility paradigms could be tackled by international requirements to provide sector-specific emissions inventories. Requiring states to provide information on their progress towards decarbonising transport would help facilitate state-to-state accountability, which could in turn stimulate pressure to undertake more ambitious sectoral climate action. In addition to the pressures generated by international scrutiny, specifically highlighting the (particularly poor) performance of the sector could also help emphasise the urgency to move away from traditional mobility paradigms and pursue demand management strategies.

Fourth, international institutions can provide **(4) means of implementation** through capacity-building, technology transfer and mobilising financial resources between members. The provision and mobilisation of resources, in addition to strengthening capacity-building, could be key in addressing economic, practical and technological barriers concerning high investment costs required for infrastructure, capacity limitations and unequal access to charging infrastructure. First, it can provide countries with the necessary financial resources and general capacity to decarbonise their transport systems, where more pressing development demands typically take priority, particularly for urbanising areas in the Global South (United Nations, 2021). Even in countries that already possess a high level of ambition to decarbonise their transport systems can be hindered by these barriers. The provision of support is thus key in scaling up the processes required for deep decarbonisation and enabling the delivery of sustainable mobility systems.

Fifth, international institutions can provide platforms to enhance **(5) knowledge and learning** through sharing information between members, in addition to diffusing best practices or enabling collaboration between stakeholders. Knowledge and learning could help tackle technological barriers concerning the slow adoption of digitised services for demand management, in addition to the performance of EV batteries. Given that digitised services such as MaaS are still in their infancy, international institutions could create platforms to research and explore potential barriers and enablers to their adoption. In terms of EV battery performance, technology is continuing to evolve.

Accordingly, institutions could also establish platforms to facilitate research into advancements and diffuse technological innovations.

Last, international institutions can **(6) orchestrate and coordinate** other existing institutions to promote collaboration and synergies. International institutions could address political and institutional barriers concerning traditional, carbon-intensive mobility paradigms by promoting collaboration and synergies across decarbonisation pathways. By coordinating efforts and ultimately mainstreaming a decarbonisation pathway for the sector across varying institutions, this would help to legitimise and normalise a new paradigm for transport focused on managing demand.

2.3 Sectoral governance landscape: Remaining gaps and underexploited potential

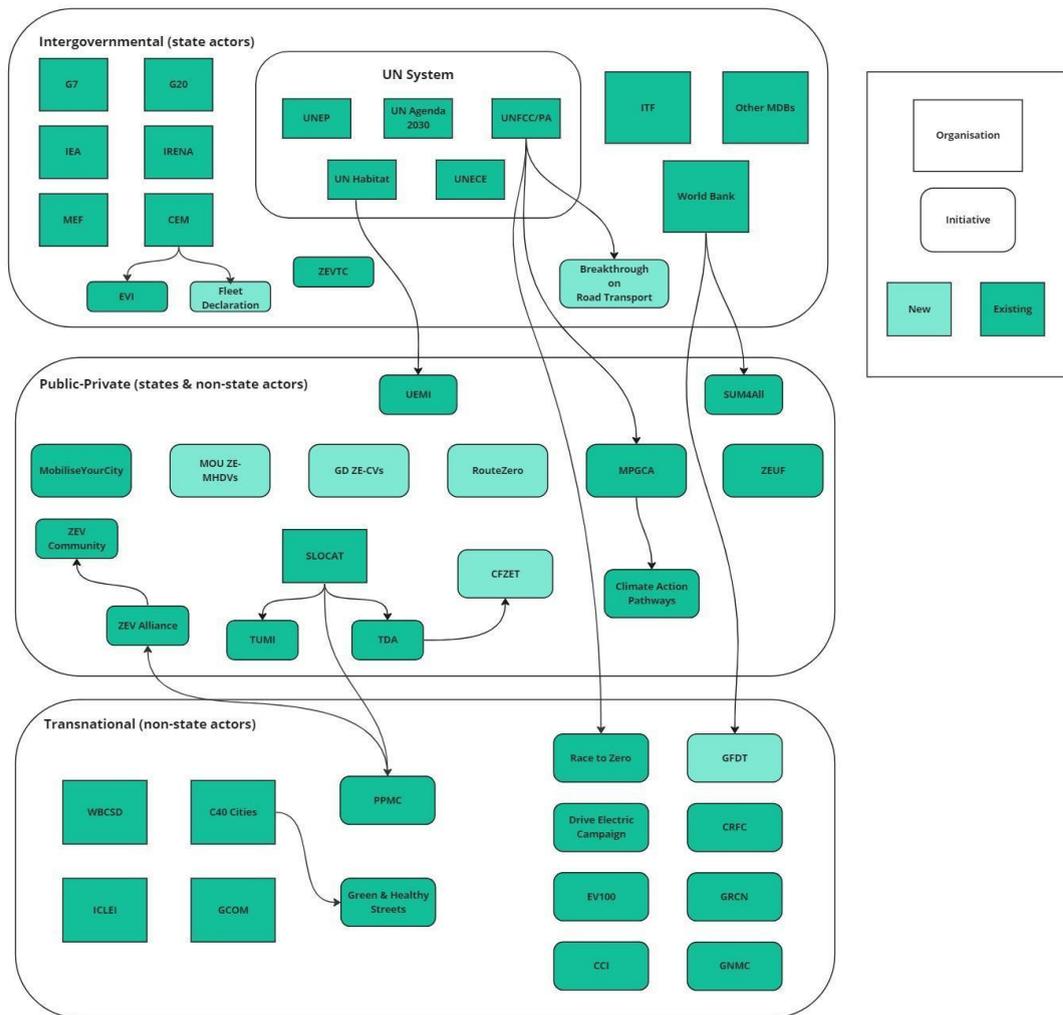
Building on and updating Obergassel et al. (2021), this section identifies to what extent international institutions have exploited the governance potential discussed in section 2.2. As part of this mapping exercise, we cover transnational and intergovernmental institutions whose work (1) actively contributes towards the decarbonisation of land transport; and (2) fulfils a certain level of institutionalisation, such as the existence of rules or procedures towards a common purpose, substantive actions, as well as possessing a degree of permanence (Oberthür, Hermwille and Rayner, 2021).

2.3.1 Overview of governance supply for the decarbonisation of land transport

The governance landscape for land transport is highly dynamic. However, the International Transport Forum (ITF) is the only intergovernmental institution that specifically develops policy in the field of transport. Alongside the ITF, there are multiple UN bodies that pursue sustainable mobility related activities, such as the United Nations Environment Programme (UNEP), the United Nations Economic Commission for Europe (UNECE), and the United Nations Human Settlements Programme (UN-Habitat). Additionally, there are a number of other international institutions that actively contribute to the decarbonisation of land transport, such as the International Energy Agency (IEA), the International Renewable Energy Agency (IRENA), the G20 and G7, and the World Bank.

In addition, there are several other relevant institutions, partnerships, and initiatives. Examples include, but are not limited to, the Paris Process on Mobility and Climate (PPMC) established by the Partnership on Sustainable, Low Carbon Transport (SLOCAT) and the Transport Decarbonisation Alliance (TDA). There are also various city networks, such as C40 cities and the Global Covenant of Mayors for Climate and Energy (GCoM). Figure 1 provides an overview of the governance landscape. New institutions that have been created since Obergassel et al. (2021) are highlighted.

FIGURE 1: OVERVIEW OF GOVERNANCE LANDSCAPE.



2.3.2 Guidance and signal

Various international institutions provide guidance and signal through decarbonisation roadmaps and visions, but have failed to fully exploit this governance potential.

First, the **Paris Agreement** (and subsequent decisions taken by its parties) plays a key overarching role by signalling that strong mitigation action is required, such as achieving net zero by the middle of the century. The Paris Agreement accordingly provides a general long-term vision for the phasing out of global GHG emissions. However, this ambition is not specified for individual sectoral systems.

In addition, both **Agenda 2030** and the **New Urban Agenda (NUA)** offer multilateral guidance. Agenda 2030 mainstreams sustainable transport across a number of directly and indirectly related SDGs and associated targets, for example SDG 11 (sustainable cities and communities) and SDG 9 (industry, innovation and infrastructure). Similarly, the NUA provides an action-oriented roadmap for global sustainable urban development (UNGA, 2016). It gives practical guidance for sustainable mobility through the provision of guidelines to implement SDGs in urban spaces. These include a focus on significantly increasing sustainable infrastructures for public transport and providing better transport planning to reduce travel and transport needs (UNGA, 2016).

Several international institutions have issued transport-specific decarbonisation roadmaps. However, these institutions are generally limited in their authority and reach. As part of the **Marrakech Partnership on Global Climate Action (MPGCA)**, the UNFCCC launched its 'Climate Action Pathways' in 2019 for several thematic areas, including transport. The Pathways provide sectoral roadmaps and recommend actions to help realise the temperature goal of the Paris Agreement (MPGCA, 2021). For land transport specifically, the Pathway sets out four key impact areas towards achieving zero-carbon emissions that incorporate both demand management and technological solutions: reducing demand and distance, shifting to lower carbon modes of travel, building resilient transport systems, and improving vehicle, fuel and operational efficiencies (MPGCA, 2021). While these Pathways hold potential to guide state action, they have been generally regarded as a mere 'side note' to intergovernmental negotiations, and thus lack authority (Obergassel et al., 2019).

The **ITF** has also provided guidance and signals towards achieving carbon-neutral mobility through its Decarbonising Transport Initiative (ITF, 2022a). While the Initiative aims to help translate climate ambition into climate action, it does not set specific decarbonisation targets, nor does it advocate for particular policies and measures. Rather, it aims to provide targeted analytical support, and outlines a catalogue of 80+ mitigation measures (ITF, 2022a), including demand management, modal shift solutions, and technological solutions (e.g. EVs). Accordingly, it functions more as a knowledge-building process than a target-setting process.

A further institution that has issued a transport-specific decarbonisation roadmap is the **World-Bank led Sustainable Mobility for All Initiative (SUM4All)**. In 2019, SUM4All launched its 'Global Roadmap of Action Toward Sustainable Mobility' (GRA) (SUM4All, n.d). The GRA defines a pathway forward for countries to achieve sustainable mobility and attain the SDGs based on a series of action plans specific to each country (SUM4All, n.d).

There are other international institutions that have provided guidance and signal through decarbonisation roadmaps that include net-zero transport targets for 2050, including: the **PPMC** which launched a Global-Macro-Roadmap for mobility transformation between 2020-2050+ (PPMC, 2017), and the **TDA** which sets out a common vision for a number of 'front-runner' countries, cities, regions and companies, to help transform the sector towards net-zero before 2050 (TDA, 2018). While both initiatives are important in promulgating transport-specific net-zero targets, these targets are not legally binding.

To summarise, there are several institutions that provide signal and guidance through sectoral decarbonisation roadmaps and visions. While the Paris Agreement sets important overarching guidance and signals, this is not translated for specific sectors. Most of the other institutions generally possess limited authority and often have limited membership and thus reach. As a result, there is no authoritative decarbonisation vision for the transport sector, including a multilaterally agreed decarbonisation target.

2.3.3 Rules and standards

International institutions have exploited the potential to set rules and standards to a limited extent. Currently, there are no concrete international rules or standards concerning the decarbonisation of land transport. Nevertheless, there are some relevant initiatives.

Under the **Paris Agreement**, parties are required to submit five-yearly climate mitigation plans in the form of Nationally Determined Contributions (NDCs), and encouraged to develop long-term low-GHG emission development strategies. However, neither of these require a sectoral breakdown. Nevertheless, since the first generation of NDCs were submitted in 2015, there has been an increased commitment to decarbonise transport in updated NDCs (ITF, 2022b). Most importantly, the number of voluntary transport CO₂ reduction targets in updated NDCs has risen from 8% to 18% (ITF, 2022b).

At the Glasgow Climate Conference (COP26) in 2021, several important institutions were established that advance rule-setting. These initiatives set out important commitments to help accelerate the transition to zero-emission vehicles. The **Glasgow Declaration on Accelerating the Transition to 100% Zero-Emission Cars and Vans (GD ZE-CVs)** comprises 39 national governments (including 11 governments in emerging markets and developing economies), 40 cities, states and regional governments, as well as several carmakers, fleet owners, and other organisations. The GD ZE-CVs requires its signatories to work together towards all sales of new cars and vans being zero-emission globally by 2040 and by no later than 2035 in leading markets (UK Government, 2022). The **Memorandum of Understanding on Zero-Emission Medium- and Heavy-Duty Vehicles (MOU ZE-MHDVs)** comprises 16 governments, as well as subnational governments, businesses and other relevant organisations. The MOU ZE-MHDV requires its signatories to work together to achieve 100% zero-emission new truck and bus sales by 2040 (MOU ZE-MHDV, 2021). This includes an interim goal to achieve 30% zero-emission new vehicles by 2030. In addition, the UK COP26 Presidency also launched the Breakthrough Agenda, consisting of sectoral targets developed between a limited set of countries designed to advance the global deployment of clean technologies. This includes a **Breakthrough on Road Transport**, which commits its signatories to make zero-emission vehicles the 'new normal' by 2030.

In June 2022, President Biden used the third Major Economies Forum on Energy and Climate (MEF) (Whitehouse Government, 2022) to urge other countries to join new initiatives aimed at accelerating climate mitigation efforts, including a new **Collective 2030 Zero-Emission Vehicle Goal**. This new initiative invites MEF members to commit to reaching at least 50% of new light-duty vehicle sales by 2030. By accelerating ZEV deployment in key markets, the aim is to help advance a full global transformation of the automotive industry (White House, 2022). In September 2022, the **Clean Energy Ministerial (CEM) Electric Vehicle Initiative's (EVI) Zero Emission Government Fleet Declaration** was announced (CEM, 2022). This commits a limited number of governments to aim at 100% zero-emission light-duty vehicle acquisitions of civil government owned and operated fleet, and aspire towards 100% zero-emission medium-and heavy-duty vehicle acquisitions by no later than 2035 (CEM, 2022).

To work towards the development of technical vehicle standards, the **UNECE** established a working party known as the World Forum for Harmonisation of Vehicle Regulations (WP.29). The objective of WP.29 is to pursue actions aimed at the development and global harmonisation of technical vehicle regulations, which includes regulations aimed at protecting the environment and promoting energy

efficiency. More recent developments include the adoption of a new UN Global Technical Regulation on in-vehicle battery durability for EVs (GRT-BDEV) and new UN regulations on vehicle emission requirements, featuring the Worldwide Light Duty Test Procedure (WLTP). The GRT-BDEV provisions set minimum performance requirements on manufacturers for EVs regarding battery durability (UNECE, 2022). This is to ensure that only durable batteries are installed, to help promote consumer confidence and thus the uptake of EVs, as well as improve their environmental performance. The UN Regulation on WLTP sets stringent emission requirements on cars sold throughout the world, through the development of a global harmonised standard to determine the carbon dioxide emissions and fuel consumptions of light duty vehicles (UNECE, 2021). However, there is no coordination pertaining to performance standards nor are there phase-out dates or timelines concerning traditional vehicles.

There have also been some developments in relation to fiscal reforms. Since 2009, the **G20** has repeatedly committed to phasing out ‘inefficient fossil fuel subsidies that encourage wasteful consumption’ (G20, 2009). In many of the G20 countries, this extends to subsidies for transport fuels. Nevertheless, fossil fuel subsidies remain large, amounting to nearly \$700 billion in 2021 (OECD, 2022). Moreover, the G20 commitment is voluntary and does not include a target date.

Other unilateral and transnational initiatives collate pledges and commitments from their members in the form of action plans. Members of the **TDA** are required to submit action plans in the short (2020), medium (2030-2040) and long term (2050) (TDA, 2019). Members of **C40 Cities** are required to develop climate action plans that include specific measures and emission reduction targets. These action plans cover eight sectors, including transport. In 2021, 68 new action plans were implemented, bringing the total number to 871 (C40, 2021). Of these 68 action plans implemented in 2021, 23 cover the transport sector. The climate action plans include demand reduction and technological solutions, such as reducing travel, increasing public and shared modes of transport, and transitioning towards zero-emission vehicles. Similarly, members of the **GCoM** are required to formally implement action plans with measurable emission targets (GCoM, n.d.). These action plans must pursue commitments that aim to be at least as high as the commitments in their country’s NDC.

To summarise, there are hardly any concrete international rules or standards to advance the decarbonisation of land transport. While there are several institutions that require commitments and action plans from their members, there are no substantive obligations concerning national emission targets, vehicle standards, fiscal reforms or infrastructure investments.

2.3.4 Transparency and accountability

International institutions have exploited the potential to provide transparency and accountability to a limited extent.

Under the enhanced transparency framework of Article 13 of the **Paris Agreement**, parties are required to provide a national GHG inventory report, as well as report on what progress has been made in implementing and achieving NDCs. However, these reporting requirements do not necessarily focus on specific sectors, as this depends on what a party has included in its NDC, and which indicators a party chooses to use.

Other international institutions have also developed transparency frameworks that monitor transport systems within countries through indicators. Particularly notable is the Global Tracking Framework established by **SUM4All**. This framework provides a monitoring system to measure the progress of

countries towards sustainable mobility (SUM4All, 2021). It offers a global repository of data and indicators to measure the performance of countries individually and compared to each other. This framework is also accompanied by a Country Mobility Performance Dashboard, which highlights a country's transport performance and progress towards sustainable mobility. The results are published in compilation reports (SUM4All, 2020). A similar device is the global indicator framework for the SDGs and targets of the **2030 Agenda**, adopted in 2017 (UNGA, 2017). This allows for monitoring progress towards the SDGs based on a number of global indicators. However, countries can decide what indicators to monitor, generating. This has generated concerns that national indicators are replacing rather than complementing the framework, rendering it impossible to establish a common global benchmark to measure progress against (Gennari and Navarro, 2020).

Several other international institutions also require their members to provide information and data, as well as report their progress. For example, members of the **TDA** are obliged to provide up-to-date information on their objectives, actions and progress in decarbonising transport (TDA, 2019). Members of the **GCoM** are required to submit GHG emission inventories as part of the Global Common Reporting Framework (GCoM, 2018). In particular, local governments are mandated to provide detailed reports on their GHG emissions from at least three key sectors, one being transportation. Monitoring and reporting progress is publicly disclosed. Members of the **C40 Cities** are expected to report on their progress and are encouraged to develop a 'monitoring, evaluation and reporting (MER) system' (C40 Cities, 2020). These are intended to accompany climate action plans, help assess real progress, measure success, and adjust priorities accordingly.

To summarise, while the Paris Agreement entails extensive reporting obligations, these do not pay due attention to progress in individual sectoral systems. Other transport-specific transparency frameworks have, however, been developed and some institutions subject their members to reporting obligations, including in the form of GHG emissions inventories.

2.3.5 Means of implementation

Unlike the governance functions discussed thus far, the function of means of implementation has been exploited to a far more significant extent through capacity-building efforts, technological support and investment.

Under the **UNFCCC** regime, industrialised nations are required to provide means of implementation through the delivery of financial, capacity-building and technological support to developing countries. The Green Climate Fund (GCF) was adopted as an operating entity of the Financial Mechanism of the UNFCCC. The GCF aims to mobilise funding and distribute financial support to low-carbon projects in developing countries. In terms of transport-specific funding, the GCF has provided a total of \$841.1m to support developing countries' shift to low-emission and climate-resilient transport (GCF, n.d).

UN-Habitat also provides means of implementation through capacity-building and technical assistance. Together with its donors and partners, UN-Habitat supports governments in both developing and implementing sustainable urban mobility plans and investment strategies (UN-Habitat, 2022).

Both **donors** and **multilateral development banks (MDBs)** have also developed initiatives via international frameworks to help facilitate the implementation of projects, through strengthening the institutional capacities of local and national authorities. Some examples include the Transformative

Urban Mobility Initiative launched at the Habitat III Forum, MobiliseYourCity launched at COP21 in Paris, and the Urban Electric Mobility Initiative launched at the UN Climate Summit in 2014 in New York.

In 2012, at the Rio+20 conference, a commitment was made by eight of the largest MDBs to provide US\$175 billion to support the advancement and implementation of sustainable transport solutions throughout developing countries by 2022. By the end of 2019, a total of 85% of this support had been delivered. (International Institute for Sustainable Development, 2012). In 2017, the MDBs then communicated their intention to align their activities and financial flows with the Paris Agreement (MDBs, 2018). This includes the development of a Joint MDB Assessment Framework for the alignment of direct operations (MDBs, 2021). Aligning financial flows with the Paris Agreement can only materialise if no investments which undermine the temperature goal are made, meaning no investments in high-emission transport. While progress generally has been made concerning direct investment operations, the same cannot be said for indirect investment operations (McCandless et al., 2021).

A further donor was created in 2021 to provide new funding to support the decarbonisation of road transport. The **World Bank** launched their new multi-donor trust fund, the Global Facility to Decarbonise Transport (GFDT) (World Bank, 2022). Over the next 10 years, the GFDT is intending to mobilise \$200 million to help developing countries decarbonise their transport sectors (World Bank, 2021). The aim is to support the development of carbon-neutral transport systems through the deployment of low-carbon mobility, while facilitating economic growth (World Bank, 2021). In particular, the GFDT will support strategies that avoid motorised transport, shift to cleaner modes, improve vehicle efficiency, and strengthen the resilience of transport systems.

In summary, a range of institutions offer financial support for the decarbonisation of land transport. However, it is unclear to which extent financial resources are at the same time provided in support of high-emission transport (Oberghassel, Lah and Rudolph, 2021).

2.3.6 Knowledge and learning

The potential to provide knowledge and learning has been exploited to a large extent. The institutions discussed here have fulfilled this governance function by issuing best practices' data and in-depth reports and analyses, to the provision of decarbonisation roadmaps and policy guidelines, tools and handbooks.

At the UN level, various institutions contribute towards the provision of knowledge and learning. Under the **UNFCCC**, the Technical Examination Process has convened a series of expert meetings to collate good practice policies across a variety of sectors, including transport. **UN-Habitat** also has helped disseminate knowledge and best practices, including through an Urban Best Practices Database, which serves as a repository for knowledge, policies, lessons learnt and success stories in relation to the urban environment. UN-Habitat also provides an extensive package of knowledge, expertise and international best practices to help support governments in the implementation of sustainable urban mobility (UN-Habitat, 2022). **UNEP** has also been involved in relevant initiatives, including the Global Electric Mobility Programme, Global Fuel Economy Initiative, and Share the Road Programme. These initiatives contribute to the decarbonisation of transport through a variety of

knowledge products, such as the development of policy databases, case studies and guidance, showcasing latest developments and best practices, and providing data and research.

A range of other international institutions also facilitate knowledge exchange and learning. For example, the **SUM4All** activities largely involve knowledge dissemination and sharing, alongside issuing guidance on policymaking. The Global Roadmap of Action Toward Sustainable Mobility in particular embodies over 180 policy measures that have been globally tested. The **ITF** also fulfils this governance function, particularly through its Decarbonising Transport Initiative. Alongside gathering and distributing evidence for best practices to advance carbon-neutral mobility, the initiative also provides a catalogue of many mitigation tools (ITF, 2022a). Further to these activities, the initiative also advances global dialogue via policy briefings, workshops and high-level roundtables.

A further example is the **IEA**, which provides in-depth analyses and insights into key trends concerning energy demand and supply (IEA, 2022a). The Technology Collaboration Programmes is one example where the IEA provides knowledge and learning relevant to the decarbonisation of land transport. The Hybrid and Electric Vehicle Technology Collaboration Programme aims to address EV deployment barriers by generating and disseminating information, including scientific and technological assessments, on hybrid and electric vehicles. **IRENA** is another key example of an international institution that advances knowledge sharing and learning through a range of products. It provides a repository of knowledge that delivers practical tools, information and policy advice on renewable energy (IRENA, 2022). In terms of transport, IRENA provides for knowledge and learning through the dissemination of analyses on EVs (e.g. IRENA, 2019) and biofuels (e.g. IRENA, 2017).

To summarise, while many institutions contribute to the promotion of knowledge and learning, there is no global framework which seeks to enable exchange and discussion between countries, however. In addition, there is also no global framework that offers non-state actors a platform to provide their insights and knowledge (Obergassel, Lah and Rudolph, 2021).

2.3.7 **Orchestration and coordination of existing institutions**

International institutions have exploited the potential for orchestration and coordination of existing institutions to a very limited extent. However, some coordination efforts can be observed. The **MPCGA** aims to support the implementation of the Paris Agreement by facilitating collaboration between a range of actors. The thematic Climate Action Pathways mentioned above are a crucial part of this, by setting out sectoral visions for achieving the Paris Agreement's mitigation goals. The pathways are instrumental in promoting synergies and encouraging actors to pursue an integrated approach to climate action within their thematic areas. The Transport Thematic Group brings together a number of institutions relevant to the decarbonisation of transport, including but not limited to, the ITF, SLOCAT, IEA, PPMC, C40 Cities, and UN-Habitat. A key area of their work is to catalyse coordination and cooperation between different actors.

In addition to the work of the MPCGA, the World Economic Forum launched the **Zero-Emission Urban Fleet (ZEUF)** in 2021. The ZEUF operates as an umbrella network, to help connect and coordinate existing initiatives active in electric mobility. By promoting synergies and cooperation, the ZEUF aims to harness commitments from existing institutions and catalyse these into transformative, tangible action. Part of this involves convening relevant stakeholders to help enable coordination efforts. To

eliminate the barriers associated with the deployment of electric mobility, a key focus of the ZEUF's work is to align the work of industry and services with government strategies.

To summarise, while these institutions have sought to facilitate collaboration, the potential for orchestration and coordination has been exploited to only a very limited extent. As the governance landscape continues to evolve and become increasingly interconnected, orchestration and coordination will assume greater importance.

2.3.8 Remaining gaps in global governance of land transport

The analysis shows that the governance landscape is characterised by a growing number of international institutions. Since the analysis undertaken by Obergassel et al. (2021), new institutions have emerged, and the work of existing institutions has evolved. In particular, the analysis highlights that there is a considerable amount of activity being pursued by sub-national and non-state actors. For example, both C40 cities and GCoM require their members to commit to measurable emission reduction targets. In addition, members of GCoM are obliged to submit GHG emission inventories, including detailed reports on their transport sectors, while other institutions such as the PPMC have set transport-specific net-zero targets.

However, the analysis also highlights that there are remaining gaps across the six governance functions. The analysis shows that there is a particular lack of activity, especially in the form of strong commitments, from state governments to decarbonise land transport. For example, while the MPGCA has established a global, transport-specific roadmap under the auspices of the UNFCCC, this has not been officially endorsed by state governments. Rule-setting is especially lacking. While some governments have increasingly committed to decarbonisation pledges - such as the Breakthrough on Road Transport, the GD ZE-CV and the MOU ZE-MHDV - membership is between a limited number of countries in each of these initiatives. In addition, there is a general lack of concrete rules and standards agreed between countries. No sectoral breakdowns are required in NDCs to encourage demand reduction, nor are there any phase-out timelines agreed between governments for ICE vehicles. In addition, there are no sectoral breakdowns required under the Paris Agreement's transparency framework.

Analysing each and every governance gap lies beyond the scope of this paper. Within this paper, we identify the following governance gaps that we deem particularly important to the sector's decarbonisation and hence require more immediate attention:

- › Guidance and signal:
 - › No authoritative and centralised decarbonisation roadmap specific to transport, including the absence of a government-backed net-zero target.
- › Rules and standards:
 - › No international requirements, in the form of emission targets, for countries to decarbonise land transport.
 - › No concrete, internationally coordinated phase-out dates for fossil-fuelled vehicles.
- › Transparency and accountability:
 - › No international transparency requirements that track sector-specific country progress.

3 Options for enhancing global climate governance

In this section, we examine concrete governance options for addressing the key gaps identified above. These options explore the scope for reform of existing institutions, alongside the creation of new institutions. To this end, we first outline and discuss the assessment criteria applied to evaluate institutional options. Second, we present concrete governance options to close the remaining gaps through institutional reform. Third, we explore the potential creation of a new institution to address any remaining governance gaps.

3.1 Criteria for assessing institutional options

Before presenting our institutional options, we first outline the applicable criteria for assessing these options: (1) membership; (2) institutional strength; (3) legitimacy; and (4) feasibility.

1. Membership of the institution

The membership of the institution concerns the ‘critical mass’ for addressing the problem i.e. what actors are required to address the governance gap (Falkner, 2016; Unger, Mar and Gürtler, 2020). This includes not only states, but also non-governmental and transnational actors (Patt et al., 2022). While leadership by states may enhance the authority of an institution, non-governmental and transnational actors can also be important players in advancing decarbonisation efforts (Hale, 2018). In addition to enhancing effectiveness, these actors can also help contribute to the legitimacy of an institution, which is closely linked to membership (Kuyper, Linnér and Schroeder, 2017). It is also possible that an institution may begin with a smaller membership, but is designed to expand over time and eventually garner critical mass.

2. Institutional strength

Institutional strength concerns the capacity and expertise for addressing the governance gap (Patt et al., 2022). An important component of this concerns the ability to ensure effective implementation and compliance through transparency and accountability mechanisms (Patt et al., 2022). In addition, we consider the potential for broader effects beyond the institution itself i.e. its effect on other institutions. To this end, we consider the ‘transformative potential’ of the institution across the sector as a whole (Patt et al., 2022). Another aspect we consider when assessing institutional strength is the legal character of the institution, to determine whether it has legal competence (i.e. bindingness) across the governance functions (Patt et al., 2022).

3. Legitimacy

The legitimacy of an institution concerns how it is perceived by actors, including in a North-South context. To enjoy high legitimacy, international cooperation must ‘lead to equity with respect to the costs, benefits, and burdens of mitigation actions, taking into account current and historical contributions and circumstances’ (Patt et al., 2022, p. 13). We differentiate between input and output legitimacy (Bäckstrand, Zelli and Schleifer, 2018). In terms of input (procedural) legitimacy, this concerns the internal processes of an institution, such as the inclusion of frameworks for transparency and accountability, appropriate actors and procedural fairness (Nasiritousi and Faber, 2021; Bäckstrand, Zelli and Schleifer, 2018). In terms of output legitimacy, we refer to ‘substantive’ legitimacy i.e. what is produced by, and the effects of, the decisions made by an institution

(Bäckstrand and Nasiritousi, 2021; Nasiritousi and Faber, 2021; Bäckstrand, Zelli and Schleifer, 2018). To this end, we consider the legitimacy of an institution to be the extent to which it has obtained acceptability and is hence deemed authoritative (Stupak, Mansoor and Smith, 2021).

4. Feasibility

Political feasibility relates to the concept of a gap between the ‘desirable and the possible’ (Skodvin, Gullberg and Aakre, 2010). When assessing the feasibility of an institution, we therefore consider whether there are sufficient incentives (i.e. ‘carrots’), for the main actors whose cooperation and consent may be required (Aakre, 2016). Accordingly, we also consider under feasibility who the potential ‘frontrunners’ or ‘champions’ may be. For example, international cooperation between a limited number of enthusiastic countries may help aid feasibility, rather than pursuing the typical ‘broad then deep’ approach to governance (Victor, 2011). For the reform of existing institutions, this assessment considers compatibility with the established objectives of the institution, as well as the prospect for agreement on reform. For example, to what extent is there institutional rigidity or lock-ins based on consensus requirements of past experience (Vihma, 2015)? At the international level, multilateral approaches are more likely to be limited by consensus-based decision making (Falkner, 2016). As a result, a more ‘targeted approach’ between a smaller number of players may prove more feasible (Victor, 2006; Brenton, 2013). For the creation of new institutions, this assesses how a new institution would be linked to and complement or arise from existing institutions in an increasingly populated governance system (Falkner, 2016). It also considers whether there are any particular forums or venues to initiate the creation of a new institution, as well as possible paths towards a fully functional institution.

3.2 Reforming one or more institutions: Reducing demand for motorised transport

Applying these criteria, this section presents options for closing the governance gaps through institutional reform. Our analysis finds that the reform of an existing institution – the UNFCCC – could address three of the governance gaps: (1) developing an authoritative, centralised roadmap and international net-zero target, (2) setting sector-specific, international emission targets, and (3) elaborating sector-specific, international transparency requirements.

As mentioned in Section 2.3.8, the main governance gaps relate to a lack of commitments from countries. Accordingly, to address these three gaps, institutions must be intergovernmental in nature and ideally, have global membership if the gaps are to be adequately addressed internationally. This means that several international institutions are less relevant due to their lack of government membership. For example, MobiliseYourCity only has 15 member countries.

While the IEA has 31 member countries in total, including a number of the world’s major emitters, its membership is nevertheless limited. It is predominantly made up of wealthy developed countries, and emerging economies such as China and India are not members. Accordingly, it also lacks legitimacy from the perspective of non-members. Moreover, while generally seen as authoritative on energy-related issues, its work is generally restricted to providing data, analysis and policy recommendations (IEA, 2022a). It does not have the legal competence to set rules. Limited membership is also the case for the G20 and G7, with both representing most of the world’s largest economies, accounting for 27% and 80% of global GDP respectively in 2021 (World Economic, 2021a;

World Economic, 2021b). In addition, their legitimacy has been questioned (Brandi, 2019, p. 691). Both the input and output legitimacy of the G7 has been deemed particularly low; as a smaller summit group, it is perceived as increasingly 'less representative and less capable' of tackling global issues (Brandi, 2019). Moreover, in terms of political feasibility, this often restrains the ability of the G20 to progress, particularly in relation to the adoption of rules and strengthening transparency.

UN-programmes such as UNEP and UN-Habitat possess high membership. Unlike minilateral forums initiated by an exclusive group of countries, such as the G7, these UN-programmes do not suffer from limited government participation, which enhances their legitimacy (Karlsson-Vinkhuyzen and McGee, 2013). However, the overall procedural legitimacy of UNEP has been described as lacking (Ivanova, 2005). This is also the case for UN-Habitat, where an independent review panel identified limitations in its transparency and accountability processes (UN, 2017). In addition, while these bodies pursue environmental sustainability and at times, sustainable mobility-related issues, the focus of their mandates is much wider. For example, the focus of UN-Habitat is the provision of a better quality of life (UN-Habitat, 2022). This is also applicable to IRENA. Despite its near-universal membership, its focus is exclusively limited to renewable energy (IRENA, 2022).

The ITF is the only intergovernmental institution that is specifically dedicated to developing policy in the field of transport. In addition, it also has fairly high membership (61 member countries). Nevertheless, the ITF operates as a think tank. Its key activities generally involve policy analysis, disseminating knowledge and facilitating dialogue (ITF, 2022c). It accordingly lacks legal competence and authority and hence, the capacity to adequately address these governance gaps.

This leaves the UNFCCC. First, the UNFCCC has near-universal membership with 198 parties. In addition, it enjoys very high authority and legitimacy (Karlsson-Vinkhuyzen and McGee, 2013). This is evidenced in particular by the commitment made from all parties to a global temperature goal under the Paris Agreement, alongside the submission of NDCs. In terms of institutional strength and capacity, it possesses legal competence to act on all of the governance functions, including rule-setting. In addition, it is highly institutionalised, with decision-making through the COP and administrative support provided by the UNFCCC Secretariat.

Accordingly, the UNFCCC has the necessary membership, institutional strength, legitimacy and capacity to address these governance gaps. Nevertheless, while the most fitting institution, it is important to note that its near-universal membership and consensus-based decision-making process can generate feasibility issues. We take this into consideration in the analysis below.

TABLE 2: ASSESSMENT OF CRITERIA IN RELATION TO THE UNFCCC.

Criteria	Assessment of UNFCCC against criteria
Membership	<ul style="list-style-type: none"> → Near-universal membership (198 parties) → Composed of states
Institutional strength	<ul style="list-style-type: none"> → Possesses legal competence across all of the governance functions → Long-standing and strong secretariat → Supreme decision-making and governing body (COP)
Legitimacy	<ul style="list-style-type: none"> → Enjoys high degree of legitimacy, which is also linked to its near-universal membership (198 countries committed to a global temperature goal) → Possesses high level of authority
Feasibility	<ul style="list-style-type: none"> → Important to consider though that high membership can cause feasibility issues due to competing interests among parties → Decision-making based on consensus, so can limit ambition

Creation of an international net-zero target for the transport sector

While several institutions have provided guidance and signals in the form of transport-specific decarbonisation roadmaps and targets, they lack authority and have limited membership. However, if the global mitigation objective of the Paris Agreement was broken down into net-zero targets for sectors, accompanied by individual roadmaps, this would send powerful international guidance and signals to parties on common transformations needed at the sectoral level.

A transport-specific roadmap and net-zero target would send strong guidance to parties on the importance of abandoning existing carbon-intensive transport policy and planning paradigms. Ideally, this would promulgate a new paradigm for transport that focuses on reducing demand for motorised transport. In addition to the creation of a net-zero target, a potential roadmap could also include interim emission reduction targets e.g. for 2030 and 2040.

The new work programme to scale up mitigation ambition and implementation before 2030 provides a promising avenue to develop such a roadmap that includes a net-zero target. The details of the work programme will be fleshed out at COP27. The new work programme could potentially provide a framework to develop sector-specific roadmaps and targets. It could also establish sectoral discussions or dialogues at the intergovernmental level, aimed at defining pathways towards decarbonisation. Specifically, this could involve the development of a transport-specific decarbonisation roadmap. These dialogues could take place in advance of the annual high-level ministerial roundtables on pre-2030 ambition, due to begin at COP27, to ramp up sectoral action ahead of these roundtables.

These discussions could potentially build on the work that is already being carried out by the High-Level Climate Champions under the MPGCA. While the Climate Action Pathways set important sectoral visions to achieve the long-term goals of the PA through sector-specific roadmaps and net-zero targets, the work conducted under the auspices of the MPGCA is not directly connected to intergovernmental negotiations. Linking the work of the High-Level Climate Champions to a formal intergovernmental process such as the new WP would require parties to engage with and consider sectoral approaches. To this end, the COP could request that the Champions provide inputs to the new work programme. In a further step, the COP could formally endorse the Pathways and request parties to consider these when updating their NDCs and long-term low-GHG emission development strategies.

If the UNFCCC was to establish a decarbonisation roadmap of this nature, it would not only help drive a sectoral transformation at the international level, but also facilitate alignment and coordination amongst institutions already working towards sustainable mobility.

Integrating sector-specific emission budgets into NDCs and the development of a new breakthrough

International governance is particularly deficient in advancing rule-making. The extent to which the UNFCCC and Paris Agreement offers sectoral specification on rules and standards is especially limited, given that its primary focus concerns global emissions. Neither NDCs nor long-term low-GHG emission development strategies require a sectoral breakdown.

However, one possible way forward could be the introduction of legally binding emissions budgets with sector-specific targets, including for transport. To this end, the UNFCCC could offer a way forward by requiring parties to set out sector-specific emissions budgets in their NDCs. These budgets could set out a maximum quantity of transport-related emissions that can be released during a specified time period that are consistent with the temperature goal of the Paris Agreement. This could help to dismantle existing, carbon-intensive mobility paradigms. By tying countries to quantified budgets, states would come under increasing pressure to decarbonise their transport systems and ultimately pursue demand reduction strategies.

While re-opening the NDC guidance to make sector-specific commitments mandatory will probably be politically unfeasible, however, the new WP could offer a way forward by *inviting* parties to *voluntarily* incorporate sectoral commitments into their NDCs, including in the form of emissions budgets. An example of a country that has already introduced legally binding emissions budgets is Germany. The German Federal Climate Change Act 2019 (amended in 2021) stipulates annual emissions budgets for all sectoral systems until 2030, including transport. If this was to be replicated at the international level, this could greatly advance the supply of rule-setting and help accelerate the sector's transformation towards sustainability and decarbonisation.

In addition, parties could also potentially use future COP sessions as platforms for advancing sectoral initiatives and frontrunner alliances. At COP26, a number of sectoral initiatives were launched by subgroups of parties (and non-party stakeholders). The Glasgow Breakthroughs are particularly notable. However, while the Breakthrough on Road Transport commits parties to make zero-emission vehicles the new normal by 2030, a full transformation of the sector will require more than a progressive shift towards EVs. Existing transport infrastructures are heavily carbon-intensive and embedded in car-reliant lifestyles. Accordingly, a complete decarbonisation of the sector will require

transitioning to less carbon-intensive modes of travel (e.g. cycling), as well as an overall reduction in motorised travel generally.

As part of the Global Checkpoint Process established for the Breakthrough Agenda, signatories have agreed to develop enhanced commitments, including in the form of new sectoral Breakthroughs. One option could possibly involve the launch of a broader government-led Breakthrough for the land transport sector, drawing on the model of the existing Glasgow Breakthroughs. Ideally, this Breakthrough would commit interested governments to a sector-wide emission reduction target specified for land transport. While a Breakthrough that commits governments to an emission reduction target is the most ambitious option, failing that, governments could prioritise the development of further Breakthroughs, consisting of targets specific to decarbonising land transport.

International requirements to review individual emitting sectors and sectoral initiatives

While the enhanced transparency framework of the Paris Agreement provides a framework to track progress, its reporting requirements do not pay particular attention to individual sectoral developments. More specifically, they do not oblige parties to present what exact barriers are currently hindering sectoral transformations towards decarbonisation. The transparency framework hence fails to capture the specific performance of the transport sector. This lack of scrutiny at a sectoral level does little to stimulate or influence change.

To address the lack of attention paid to sector-specific developments, interested parties could work together to build on the Paris Agreement's transparency framework and advance this process. Ideally, this would involve the development of additional reporting requirements that analyse separate emitting sectors in addition to aggregate emissions. As well as promoting state-to-state accountability and international scrutiny, this would also specifically highlight the particularly poor performance of the transport sector. Accordingly, this could help emphasise the need to abandon traditional mobility paradigms, and encourage parties to pursue mitigation strategies that focus on managing demand. However, the first review and potential updates to the modalities, procedures and guidelines of the transparency framework is not due until 2028 (UNFCCC, 2019). The likelihood of re-opening negotiations to strengthen these transparency provisions is low, given that these negotiations were intensely contested in the first place. Accordingly, alternative avenues to strengthen transparency and accountability at a sectoral level should be considered.

The new work programme to scale up ambition and mitigation provides a possible way forward to enhance the tracking of sectoral commitments. First, if the work programme invites parties to incorporate sectoral action into their NDCs, progress on these sectoral commitments would be captured by the enhanced transparency framework. More specifically, the work programme itself could provide a fitting framework to track and monitor sectoral progress. As part of the work programme and annual high-level ministerial roundtables on pre-2030 ambition, it could be made explicit that there will be an expectation on parties to show how they have scaled up ambition and implementation in terms of their NDCs. Additionally, this expectation could also possibly extend to cover sectoral progress i.e. parties would also be required to demonstrate how they have been scaling up ambition and implementation in relation to sectoral commitments (e.g. those established at COP26 such as the Glasgow Breakthrough on Road Transport).

3.3 Creation of a climate club on EVs: Electrifying motorised transport

As shown above, the majority of the governance gaps can be addressed through institutional reform. However, the lack of concrete rules for vehicle regulations and in particular, specific phase-out dates for fossil-fuelled vehicles, may require the creation of a new institution. Accordingly, this section explores the possible formation of a climate club focused on electric mobility. In addition, we also consider what other governance functions beyond rule-setting such a club could fulfil.

Several countries are taking steps to implement domestic strategies to advance the uptake of EVs. In addition, there has been an unprecedented number of recent commitments and coalitions established to advance low-carbon transport, particularly at COP26. While these developments are encouraging, what is still missing is internationally coordinated phase-out dates for fossil-fuelled vehicles. Interested countries could address this by creating a new institution in the form of a climate club focused on electric mobility, which could set explicit phase-out dates for conventional vehicles.

The automobile industry is highly concentrated. As mentioned earlier, the EU, China and California alone are responsible for half of all car sales worldwide and ten countries account for 3/4 of sales (Oberghassel et al., 2021). As well as dominating the market, the EU, China and California are also demonstrating clear leadership in terms of accelerating EV production and deployment. All three have set ambitious, world-leading goals. As part of the Fit For 55 package, an overwhelming majority of EU Member States have voted that from 2035, all new cars and vans will be zero-emissions (European Climate Foundation, 2022). A final decision will be negotiated and reached with the European Parliament, who also support a full ban on the sale of ICE vehicles by 2035. China has set an electrified-car sales target of 25% by 2025, rising to 40-50% by 2030 (Dai et al, 2020). California's AB 32 climate change programme aims to have 1.5 million passenger zero-emission vehicles on the road by 2025, and 4.2 million by 2030 (State of California, 2018). More importantly, California has proposed to phase out the sale of new gasoline-fuelled vehicles by 2035.

These key manufacturing countries are in a unique position to work together and pave the way towards a global transition to zero-emission transport. If a fairly small number of frontrunner countries were to collaborate and harmonise their trajectories, this would have a significant impact on the market globally. In 2021, Europe and China together were responsible for over 85% of global EV sales (IEA, 2022b). Between 2011 and 2022, California has accounted for nearly 43% of all electric vehicle sales in America (Veloz, 2022). As well as setting a specific target for phasing out fossil-fuelled vehicles by a given date (e.g. 2030), members of such a club could also commit to harmonising market-share targets for zero-emission vehicles and zero-emission vehicle charging infrastructure.

In terms of membership, the high concentration of vehicle production is thus key. A coalition between a limited number of frontrunner countries would probably suffice to generate a large enough impact on the global market. However, a climate club made up of only key car-producing countries could potentially lead to equity issues. For example, buyer countries would have to heavily invest in charging infrastructure and continuing maintenance, as well as potential adaptations to electricity grids. Accordingly, this speaks for broader participation. Nonetheless, it would be possible to establish a new institution that begins with a smaller membership (i.e. a limited number of key car-producing countries), but is designed to expand over time in an open and gradual manner. As well as governments, the membership of such a club could extend to important non-governmental actors, such as major car-manufacturing companies.

With regard to institutional strength, the club must be able to have broader effects beyond the institution itself, i.e. the ability to influence the global market. To this end, the club must be capable of globally phasing out fossil-fuelled vehicles and have the capacity to drive a full electrification of the vehicle fleet. The inclusion of compliance mechanisms is crucial to this (Patt et al., 2022). Transparency and accountability requirements are key to enforcing compliance with rules. A prospective club could thus include the necessary reporting and follow-up requirements to monitor member progress and ensure that any implementation gaps can be sufficiently addressed.

Closely linked to membership is the legitimacy of the club. While cooperation between several key car-producing and frontrunner countries is imperative, any coalition must also be legitimate to the Global South and emerging economies. Enabling membership to expand would not only help accelerate the transition to zero-emission transport, but also allow for a climate club to be deemed inclusive and non-protectionist, and hence strengthen its legitimacy. However, many of these countries will lack the resources required to make a full transition to electric mobility. The role of means of implementation is key here, which will likely be required to help developing countries overcome technological, infrastructural and financial limitations to EV deployment. In addition to means of implementation, the inclusion of transparency requirements would also be crucial to the perceived legitimacy of a prospective climate club.

With regard to feasibility, the most promising way forward is to start with a 'coalition of the willing', i.e. a number of frontrunner countries that are committed to phasing out fossil fuelled vehicles. As highlighted above, these key manufacturing countries have not only demonstrated this commitment by setting their own domestic targets, but are also leading the world in terms of EV deployment. To this end, membership should involve key champions in the field. However, what will be vital in moving forward is the inclusion of appropriate incentives to encourage membership over time.

TABLE 3: ASSESSMENT OF POTENTIAL CLIMATE CLUB CRITERIA.

Criteria	Assessment of potential climate club against criteria
Membership	<ul style="list-style-type: none"> → Representatives of key car-producing countries at minimum, to ensure transformative effect on global automobile market → Equity considerations in relation to buyer countries speak for broader membership → Possible to start with a smaller membership and expand over time → Ensure inclusion of key non-governmental actors, e.g. main manufacturing companies
Institutional strength	<ul style="list-style-type: none"> → Competence to establish rules in the form of an explicit phase-out date for fossil-fuelled vehicles in addition to compliance mechanisms → Ability to influence global market and drive a full electrification of the vehicle fleet
Legitimacy	<ul style="list-style-type: none"> → Legitimate to Global South and emerging economies with capacity to provide support → Role of means of implementation crucial to overcome technological, infrastructural and financial limitations to EV deployment
Feasibility	<ul style="list-style-type: none"> → Initially start with countries that have demonstrated their commitment to phasing-out fossil-fuelled vehicles → The inclusion of appropriate incentives will be key in expanding membership

4 Conclusion

This paper has analysed to what extent international governance can transform the sector towards deep decarbonisation. The current governance landscape is characterised by a high number of international institutions and initiatives, including UN bodies, multi-stakeholder partnerships, and city networks. In recent years, various initiatives dedicated specifically to the decarbonisation of transport have emerged, increasing the supply of targeted governance.

Nevertheless, this paper has identified a number of significant and remaining governance gaps, specifically, the lack of: (1) an authoritative and centralised decarbonisation roadmap for transport, including the absence of a government-backed net-zero target; (2) international requirements in the form of emission targets, for countries to decarbonise land transport; (3) concrete, internationally coordinated phase-out dates for fossil-fuelled vehicles; and (4) international transparency requirements that track sector-specific progress at the country level. Our assessment finds that global governance holds significant potential to address these gaps and ultimately advance the decarbonisation of the land transport sector.

As highlighted in Section 3, several of these governance gaps can be addressed through institutional reform of the UNFCCC. Our analysis finds that the new work programme to scale up mitigation ambition and implementation before 2030 could offer a fitting framework to develop an authoritative roadmap and international net-zero target for the transport sector. We propose that the new work programme could also provide a possible avenue to integrate transport-specific commitments into NDCs, potentially in the form of emissions budgets. However, we also suggest that parties could use future COP sessions as platforms to advance further initiatives and frontrunner alliances, particularly in the form of a new Breakthrough for land transport. In addition, we propose that the new work programme also presents a promising way forward to enhance the tracking of sector-specific progress in countries.

In terms of addressing the lack of concrete rules concerning vehicle regulations however, our analysis finds that this will require the establishment of a new institution. To this end, we propose the creation of a potential climate club focused on electric mobility, that includes explicit phase-out dates for conventional vehicles.

This paper has offered concrete governance options to address some of the most pressing gaps relevant to the decarbonisation of land transport. While our paper has captured and assessed a number of key governance gaps, it is vital that all gaps are ultimately addressed to ensure a complete transformation of the sector by 2050. If existing trends continue, the sector will become a major barrier to realising the 1.5°C goal. Despite significant challenges, however, this paper has demonstrated that global climate governance offers a road to deep decarbonisation and transformative sectoral change in land transport.

References

- Aakre, S. (2016). The political feasibility of potent enforcement in a post-Kyoto climate agreement. *International Environmental Agreements: Politics, Law and Economics*, 16, 145-159. <https://doi.org/10.1007/s10784-014-9238-5>.
- Abbott, K. (2018). Orchestration: Strategic Ordering in Polycentric Governance. In A. Jordan, D. Huitema, H. van Asselt & J. Forster (Eds), *Governing Climate Change: Polycentricity in Action* (pp. 188-209). Cambridge University Press.
- American Automobile Association. (2019). *AAA Electric Vehicle Range Testing: AAA proprietary research into the effect of ambient temperature and HVAC use on driving range and MPGe*. AAA. <https://newsroom.aaa.com/wp-content/uploads/2019/06/AAA-Electric-Vehicle-Range-Testing-Report.pdf>.
- Bäckstrand, K., Zelli, F., & Schleifer, P. (2018). Legitimacy and Accountability in Polycentric Climate Governance. In A. Jordan, D. Huitema, H. van Asselt & J. Forster (Eds), *Governing Climate Change: Polycentricity in Action*. (pp. 338-356). Cambridge University Press.
- Brandi, C. (2019). Club governance and legitimacy: The perspective of old and rising powers on the G7 and the G20. *South African Journal of International Affairs*, 26(4), 685-702. <https://doi.org/10.1080/10220461.2019.1697354>
- Brenton, A. (2013). 'Great Powers' in climate politics. *Climate Policy*, 13(5), 541-546. <https://doi.org/10.1080/14693062.2013.774632>.
- C40 Cities. (2020). *C40 City Monitoring, Evaluation and Reporting Guidance*. C40 Cities. https://cdn.locomotive.works/sites/5ab410c8a2f42204838f797e/content_entry5ab410fb74c4833febe6c81a/5f8f40cc25fb7d00ac5dec06/files/City_CAP_MER_Guidance_Final.pdf?1603400978.
- Clean Energy Ministerial. (2022). Landmark zero-emissions government fleet declaration announced in Pittsburgh. CEM. <https://www.cleanenergyministerial.org/landmark-zero-emissions-government-fleet-declaration-announced-in-pittsburgh/>
- Cohen, S., Higham, J., Gössling, S., Peeters, P., & Eijgelaar, E. (2016). Finding effective pathways to sustainable mobility: bridging the science-policy gap. *Journal of Sustainable Tourism*, 24(3), 317-334. <https://doi.org/10.1080/09669582.2015.1136637>.
- Competition and Markets Authority. (2021). *Electric vehicle charging market study: final report*. CMA. <https://www.gov.uk/government/publications/electric-vehicle-charging-market-study-final-report/final-report>.
- Creutzig, F., Roy, J., Lamb, W., Azevedo, I., Bruine de Bruin, W., Dalkmann, H., Edelenbosch, O., Geels, F., Grubler, A., Hepburn, C., Hertwich, E., Khosla, R., Mattauch, L., Minx, J., Ramakrishnan, A., Rao, N., Steinberger, J., Tavoni, M., Ürge-Vorsatz, D., & Wber, E. (2018). Towards demand-side solutions for mitigating climate change. *Nature Climate Change*, 8, 260-271. <https://doi.org/10.1038/s41558-018-0121-1>.
- Dai, F., Barnes, A., Elkind, E., Wang, Y., & Luh, A. (2020). *How California and China, Together, Can Accelerate a Global Shift to Zero-emission Vehicles*. CCCI. <https://ccci.berkeley.edu/news/2020/04/how-california-and-china-together-can-accelerate-global-shift-zero-emission-vehicles>.
- Driscoll, P. (2014). Breaking Carbon Lock-In: Path Dependencies in Large-Scale Transportation Infrastructure Projects. *Planning Practice & Research*, 29(3), 317-330. <https://doi.org/10.1080/02697459.2014.929847>.
- European Automobile Manufacturers' Association. (2022). Electric cars: *Half of all chargers in EU concentrated in just two countries*. ACEA. <https://www.acea.auto/press-release/electric-cars-half-of-all-chargers-in-eu-concentrated-in-just-two-countries/>.
- European Climate Foundation. (2022). *The 'Fit for 55' Package at a glance*. ECF. <https://europeanclimate.org/stories/the-fit-for-55-package-at-a-glance/>.
- Figuroa, M., Lah, O., Fulton, L.M., McKinnon, A., & Tiwari, G. (2014). Energy for transport. *Annual Review of Environment and Resources*, 39, 295-325. <https://doi.org/10.1146/annurev-environ-031913-100450>.
- Falkner, R. (2016). A Minilateral Solution for Global Climate Change? On Bargaining Efficiency, Club Benefits, and International Legitimacy. *Perspectives on Politics*, 14(1), 87-101. <https://doi.org/10.1017/S1537592715003242>.

- G20. (2009). *G20 Leaders Statement: The Pittsburgh Summit*. <http://www.g20.utoronto.ca/2009/2009communiqu0925.html>.
- Gennari, P., & Navarro, D. (2020). *Are we serious about achieving the SDGs? A statistician's perspective*. IISD. <https://sdg.iisd.org/commentary/guest-articles/are-we-serious-about-achieving-the-sdgs-a-statisticians-perspective/>.
- Global Covenant of Mayors. (2018). *Global Covenant of Mayors Common Reporting Framework*. GCoM. https://www.globalcovenantofmayors.org/wp-content/uploads/2019/04/FINAL_Data-TWG_Reporting-Framework_web_site_FINAL-13-Sept-2018_for-translation.pdf.
- Global Covenant of Mayors. (n.d). *City Journey*. GCoM. <https://www.globalcovenantofmayors.org/journey/>.
- Gössling, S., Schröder, M., Späth, P., & Freytag, T. (2016). Urban Space Distribution and Sustainable *Transport*. *Transport Reviews*, 36(5), 659-679. <https://doi.org/10.1080/01441647.2016.1147101>.
- Green Climate Fund. (n.d). *Transport*. GCF. <https://www.greenclimate.fund/results/transport>.
- Hale, T. (2018). *The Role of Sub-state and Non-state Actors in International Climate Processes*. Research Paper. Chatham House. <https://www.chathamhouse.org/sites/default/files/publications/research/2018-11-28-non-state-sctors-climate-synthesiss-hale-final.pdf>.
- Hardman, S., Jenn, A., Tal, G., Axsen, J., Beard, G., Daina, N., Figenbaum, E., Jakobsson, N., Jochem, P., Kinnear, N., Plötz, P., Pontes, J., Refa, N., Sprei, F., Turrentine, T., & Witkamp, B. (2018). A review of consumer preferences of and interactions with electric vehicle charging infrastructure. *Transportation Research Part D: Transport and Environment*, 62, 508-523. <https://doi.org/10.1016/j.trd.2018.04.002>.
- Hsu, C., & Fingerman, K. (2021). Public electric vehicle charger access disparities across race and income in California. *Transport Policy*, 100, 59-67. <https://doi.org/10.1016/j.tranpol.2020.10.003>
- International Energy Agency. (2022a). *Mission: The IEA works with governments and industry to shape a secure and sustainable energy future for all*. IEA. <https://www.iea.org/about/mission>.
- International Energy Agency. (2022b). *Global EV Outlook 2022: Securing supplies for an electric future*. IEA. <https://iea.blob.core.windows.net/assets/ad8fb04c-4f75-42fc-973a-6e54c8a4449a/GlobalElectricVehicleOutlook2022.pdf>.
- International Institute for Sustainable Development. (2012). *Multilateral Development Banks Announce US\$175 Billion for Sustainable Transport*. IISD. <http://sdg.iisd.org/news/multilateral-development-banks-announce-us175-billion-for-sustainable-transport/>.
- International Renewable Energy Agency. (2017). *Biogas for road vehicles. Technology brief*. IRENA. https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2017/Mar/IRENA_Biogas_for_Road_Vehicles_2017.pdf?la=en&hash=9261CA2381C7847A515E230D03C9487AE4392B88.
- International Renewable Energy Agency. (2019). *Innovation outlook: smart charging for electric vehicles*. IRENA. https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2019/May/IRENA_Innovation_Outlook_EV_smart_charging_2019_Old.pdf?la=en&hash=080C746B6183DF9C528FA4C4C4FAE801F07D93C2.
- International Renewable Energy Agency. (2022). *Vision and mission*. IRENA. <https://www.irena.org/statutevisionmission>.
- International Transport Forum. (2022a). *Decarbonising transport initiative*. ITF. <https://www.itf-oecd.org/decarbonising-transport>.
- International Transport Forum. (2022b). *How serious are countries about decarbonising transport?* ITF. <https://www.itf-oecd.org/ndc-tracker/en>.
- International Transport Forum. (2022c). *About ITF*. ITF. <https://www.itf-oecd.org/about-itf>.
- Ivanova, M. (2005). Can the Anchor Hold? Rethinking the United Nations Environment Programme for the 21st Century. *Forestry and Environmental Studies Publications Series*, 27, 1-60. https://elischolar.library.yale.edu/fes-pubs/27?utm_source=elischolar.library.yale.edu%2Ffes-pubs%2F27&utm_medium=PDF&utm_campaign=PDFCoverPages
- Jaramillo, P., Ribeiro, S., Newman, P., Dhar, S., Diemuodeke, O., Kajino, T., Lee, D., Nugroho, S., Ou, X., Strømman, H., & Whitehead, J. (2022). *Transport*. In: *Climate Change 2022: Mitigation of Climate Change*. Contribution of Working Group

- III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change https://report.ipcc.ch/ar6wg3/pdf/IPCC_AR6_WGIII_FinalDraft_Chapter10.pdf.
- Juniper Research. (2018). *Mobility-as-a-service to replace 2.3 billion private car journeys annually by 2023*. Juniper research. <https://www.juniperresearch.com/press/mobility-service-replace-2bn-private-cars-2023?ch=2.3%20billion>.
- Karlsson-Vinkhuyzen, A., & McGee, J. (2013). Legitimacy in an Era of Fragmentation: The Case of Global Climate Governance. *Global Environmental Politics*, 13(3), 56-78. https://doi.org/10.1162/GLEP_a_00183
- Keith, D., Houston, S., & Naumov, S. (2019). Vehicle fleet turnover and the future of fuel economy. *Environmental Research Letters*, 14, 1-4. <https://doi.org/10.1088/1748-9326/aaf4d2>.
- Kuyper, J., Linnér, B., & Schroeder, H. (2017). Non-state actors in hybrid global climate governance: justice, legitimacy, and effectiveness in a post-Paris era. *WIREs Climate Change*, 9(1), 1-18. <https://doi.org/10.1002/wcc.497>.
- Labee, P., Rasouli, S., & Liao, F. (2022). The implications of Mobility as a Service for urban emissions. *Transportation Research Part D: Transport and Environment*, 102, 1-25. <https://doi.org/10.1016/j.trd.2021.103128>.
- Lah, O. (2017). Decarbonizing the Transportation Sector: Policy Options, Synergies, and Institutions to Deliver on a Low-Carbon Stabilization Pathway. *Wiley Interdisciplinary Reviews. Energy and Environment*, 6(6), 1-13. <https://doi.org/10.1002/wene.257>.
- Leard, J., Linn, J., & Cleary, K. (2020). *Carbon Pricing 202: Pricing Carbon in the Transportation Sector*. Resources for the Future. <https://www.rff.org/publications/explainers/carbon-pricing-202-pricing-carbon-transportation-sector/>.
- Marrakech Partnership. (2021). *Climate Action Pathway Transport Vision and Summary*. UNFCCC. https://unfccc.int/sites/default/files/resource/Transport_Vision%26Summary_2.1.pdf.
- Mattioli, G., Roberts, C., Steinberger, J., & Brown, A. (2020). The political economy of car dependence: A systems of provision approach. *Energy Research & Social Science*, 66, 2-18. <https://doi.org/10.1016/j.erss.2020.101486>.
- McCandless, B., Neunuebel, C., Liu, S., Laxton, V., Kachi A., & A. Gebel. (2021). *MDBs Pledged to Align Financial Flows with the Paris Agreement. They're Not There Yet*. World Resources Institute. <https://www.wri.org/insights/mdbs-pledged-align-financial-flows-paris-agreement-theyre-not-there-yet#:~:text=to%20find%20something%3F-MDBs%20Pledged%20to%20Align%20Financial%20Flows%20with%20the%20Paris.They%27re%20Not%20There%20Yet&text=Two%20years%20after%20the%202015,the%20landmark%20climate%20pact%27s%20goal>
- Metzler, D., Humpe, A., & Gössling, S. (2019). Is it time to abolish company car benefits? An analysis of transport behaviour in Germany and implications for climate change. *Climate Policy*, 19(5), 542-555. <https://doi.org/10.1080/14693062.2018.1533446>.
- MOU ZE-MHDV. (2021). Memorandum of Understanding on Zero-Emission Medium- and Heavy-Duty Vehicles. <https://globaldrivetozero.org/site/wp-content/uploads/2021/11/Global-MOU-ZE-MHDVs-5-Oct-21.pdf>.
- Multilateral Development Banks. (2018). *The MDBs' alignment approach to the objectives of the Paris Agreement: working together to catalyse low-emissions and climate-resilient development*. MDBs. <http://pubdocs.worldbank.org/en/784141543806348331/Joint-Declaration-MDBs-Alignment-Approach-to-Paris-Agreement-COP24-Final.pdf>.
- Multilateral Development Banks. (2021). *Joint MDB Assessment Framework for Paris Alignment for Direct Investment Operations. BB1 and BB2 Technical Note (Working Draft as of November 2021)*. MDBs. <https://www.eib.org/attachments/documents/cop26-mdb-paris-alignment-note-en.pdf>.
- Nasiritousi, N., & Faber, H. (2021). Legitimacy under institutional complexity: Mapping stakeholder perceptions of legitimate institutions and their sources of legitimacy in global renewable energy governance. *Review of International Studies*, 47(3), 377-39. <https://doi.org/10.1017/S0260210520000431>.
- Obergassel, W., Arens, C., Beuermann, C., Hermwille, L., Kreibich, N., Ott, H.E., & Spitzner, M. (2019). *Time for Action - Blocked and Postponed. A Preliminary Assessment of COP25 in Madrid*. COP25 Report. Wuppertal Institut. https://www.researchgate.net/publication/338043558_Time_for_Action_-_Blocked_and_Postponed_A_first_assessment_of_COP25_in_Madrid.
- Obergassel, W., Lah, O., & Rudolph, F. (2021). Driving towards transformation? To what extent does global climate governance promote decarbonisation of land transport? *Earth System Governance*, 8, 1-10. <https://doi.org/10.1016/j.esg.2021.100098>.

- Oberthür, S., Hermwille, L., & Rayner, T. (2021). A sectoral perspective on global climate governance: Analytical foundation. *Earth System Governance*, 8, 1-10. <https://doi.org/10.1016/j.esg.2021.100104>.
- OECD. (2022). *Support for fossil fuels almost doubled in 2021, slowing progress toward international climate goals, according to new analysis from OECD and IEA*. OECD. <https://www.oecd.org/newsroom/support-for-fossil-fuels-almost-doubled-in-2021-slowing-progress-toward-international-climate-goals-according-to-new-analysis-from-oecd-and-iea.htm#:~:text=New%20OECD%20and%20IEA%20data,rebund%20of%20the%20global%20economy>.
- Paris Agreement. (2015). https://unfccc.int/sites/default/files/english_paris_agreement.pdf.
- Pangbourne, K., Mladenović, M., Stead, D., & Milakis, D. (2020). Questioning mobility as a service: Unanticipated implications for society and governance. *Transportation Research Part A: Policy and Practice*, 131, 35-49. <https://doi.org/10.1016/j.tra.2019.09.033>.
- Paris Process on Mobility and Climate. (2017). *A global macro roadmap outlining an actionable vision towards decarbonized, resilient transport. Implementing the Paris Agreement on climate change in the transport sector in support of a net-zero emission, climate-resilient economy by 2050 or shortly thereafter*. PPMC. <https://smartnet.niua.org/sites/default/files/resources/gmr2017.pdf>.
- Patt, A., Rajamani, L., Bhandari, P., Boncheva, A., Caparrós, A., Djemouai, K., Kubota, I., Peel, J., Sari, A., Sprinz, D., & Wettstad, J. (2022). International Cooperation. In: *Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. https://www.ipcc.ch/report/ar6/wg3/downloads/report/IPCC_AR6_WGIII_Chapter_14.pdf
- Piatkowski, D., Marshall, W., & Krizek, K. (2017). Carrots versus Sticks: Assessing Intervention Effectiveness and Implementation Challenges for Active Transport. *Journal of Planning Education and Research*, 39(1), 50-64. <https://doi.org/10.1177/0739456X17715306>.
- Pucher, J., Peng, Z., Mittal, N., Zhu, Y., & Korattyswaroopam, N. (2007). Urban Transport Trends and Policies in China and India: Impacts of Rapid Economic Growth. *Transport Reviews*, 27(4), 379-410. <https://doi.org/10.1080/01441640601089988>.
- Roberts, C. (2022). Easy stress for low-carbon mobility. The political economy of mass electric car adoption. In G. Parkhurst. & W. Clayton (Eds.), *Electrifying Mobility: Realising a Sustainable Future for the Car (Transport and Sustainability, Vol. 15)* (pp. 13-31). Emerald Publishing Limited.
- Sawa, A. (2010). Sectoral approaches to a post-Kyoto international climate policy framework. In J.E. Aldy & R.N. Stavins (Eds.), *Post-Kyoto International Climate Policy: Implementing Architectures for Agreement* (pp. 201-239). Cambridge University Press.
- Schmidt, J., Helme, N., Lee, J., & Houdashelt, M. (2008). Sector-based approach to the post-2012 climate change policy architecture. *Climate Policy*, 8(5), 494-515. <https://doi.org/10.3763/cpol.2007.0321>.
- Sims, R., Schaeffer, R., Creutzig, F., Cruz-Núñez, X., D'Agosto, M., Dimitriu, D., Meza, M., Fulton, L., Kobayashi, S., Lah, O., McKinnon, A., Newman, P., Ouyang, M., Schauer, J., Spreling, D., & Tiwari, G. (2014). Transport. In: *Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Edenhofer, O., Pichs-Madruga, R., Sokona, Y., Farahani, E., Kadner, S., Seyboth, K., Adler, A., Baum, I., Brunner, S., Eickemeier, P., Kriemann, B., Savolainen, J., Schlömer, S., von Stechow, C., Zwickel, T., & Minx, J.C. (eds.)] Cambridge University Press. https://www.ipcc.ch/site/assets/uploads/2018/02/ipcc_wg3_ar5_chapter8.pdf.
- Skeete, J.-P. (2017). Examining the role of policy design and policy interaction in EU automotive emissions performance gaps. *Energy Policy*, 104, 373-381. <https://doi.org/10.1016/j.enpol.2017.02.018>.
- SLOCAT. (2018). *Transport and Climate Change Global Status Report*. SLOCAT. <https://tcc-gsr.com/wp-content/uploads/2021/06/Slocat-Global-Status-Report-2nd-edition.pdf>.
- State of California. (2018). *Governor Brown Takes Action to Increase Zero-Emission Vehicles, Fund New Climate Investments*. California Government. <https://www.ca.gov/archive/gov39/2018/01/26/governor-brown-takes-action-to-increase-zero-emission-vehicles-fund-new-climate-investments/index.html>.
- Stupak, I., Mansoor, M., & Smith, C. Tattersall. (2021). Conceptual framework for increasing legitimacy and trust of sustainability governance. *Energy, Sustainability and Society*, 11(5), 1-57. <https://doi.org/10.1186/s13705-021-00280-x>.

- SUM4All Initiative. (2020). *Mobility Performance at a Glance: Country Dashboards 2020*. SUM4All. <https://www.sum4all.org/data/files/mobilityataglancereport-2020-spread-web.pdf>.
- SUM4All Initiative. (2021). *Global Tracking Framework for Transport*. SUM4All. <https://www.sum4all.org/global-tracking-framework>.
- SUM4All Initiative. (n.d). *Global Roadmap of Action Toward Sustainable Mobility*. SUM4All. <https://www.sum4all.org/global-roadmap-action>.
- Transport Decarbonisation Alliance. (2018). *Decarbonising transport by 2050. A TDA manifesto on how to reach net zero emission mobility through uniting Countries, Cities / Regions and Companies*. TDA. http://tda-mobility.org/wp-content/uploads/2018/12/EY_TDA-Manifesto.pdf.
- Transport Decarbonisation Alliance. (2019). *Transport Decarbonisation Alliance Charter*. TDA. <http://tda-mobility.org/wpcontent/uploads/2018/08/TDA-Charter-Template.pdf>.
- Unger, C., Mar, K., & Gürtler, K. (2020). A club's contribution to global climate governance: the case of the Climate and Clean Air Coalition. *Palgrave Communication*, 6(99), 1-10. <https://doi.org/10.1057/s41599-020-0474-8>.
- United Nations. (2017). *Organizational reform moves ahead as Guterres receives proposals on a strengthened UN-Habitat*. UN News. <https://news.un.org/en/story/2017/08/562782>
- United Nations. (2021). *Sustainable transport, sustainable development. Interagency report for second Global Sustainable Transport Conference*. UN. https://sdgs.un.org/sites/default/files/2021-10/Transportation%20Report%202021_FullReport_Digital.pdf.
- United Nations Economic Commission for Europe (n.d). *Mission - UNECE*. UNECE. <https://unece.org/mission#:~:text=UNECE's%20major%20aim%20is%20to,in%20the%20work%20of%20UNECE>.
- United Nations Economic Commission for Europe. (2021). Amendment 6 to UN GTR No. 15 (Worldwide harmonized Light vehicles Test Procedures (WLTP)). ECE/TRANS/180/Add.15/Amend.6. UNECE. <https://unece.org/sites/default/files/2021-01/ECE-TRANS-180a15am6e.pdf>.
- United Nations Economic Commission for Europe. (2022). UN Global Technical Regulation on In-vehicle Battery Durability for Electrified Vehicles. ECE/TRANS/180/Add.22. UNECE. https://unece.org/sites/default/files/2022-04/ECE_TRANS_180a22e.pdf.
- UNFCCC. (2019). Decision 18/CMA.1, Modalities, procedures and guidelines for the transparency framework for action and support referred to in Article 13 of the Paris Agreement, FCCC/PA/CMA/2018/3/Add.2. <https://ledslac.org/wp-content/uploads/2020/09/e.-Decision-18-cma.1.pdf>.
- United Kingdom. (2021). CARBIS BAY G7 SUMMIT COMMUNIQUÉ. <https://www.g7uk.org/wp-content/uploads/2021/06/Carbis-Bay-G7-Summit-Communique-PDF-430KB-25-pages-1-2.pdf>.
- United Kingdom. (2022). COP26 declaration on accelerating the transition to 100% zero emission cars and vans: Declaration. <https://www.gov.uk/government/publications/cop26-declaration-zero-emission-cars-and-vans/cop26-declaration-on-accelerating-the-transition-to-100-zero-emission-cars-and-vans>.
- United Nations General Assembly. (2015). RESOLUTION 70/1. Transforming our world: the 2030 Agenda for Sustainable Development. https://www.un.org/ga/search/view_doc.asp?symbol=A/RES/70/1&Lang=E.
- United Nations General Assembly. (2016). RESOLUTION 71/256. New Urban Agenda. https://www.un.org/en/development/desa/population/migration/generalassembly/docs/globalcompact/A_RES_71_256.pdf.
- United Nations General Assembly. (2017). RESOLUTION 71/313. Work of the Statistical Commission pertaining to the 2030 Agenda for Sustainable Development. https://www.un.org/ga/search/view_doc.asp?symbol=A/RES/70/1&Lang=E.
- United Nations Human Settlement Programme. (2022). *About Us | UN-Habitat*. UN-Habitat. <https://unhabitat.org/about-us>.
- Victor, D.G. (2006). Toward Effective International Cooperation on Climate Change: Numbers, Interests and Institutions. *Global Environmental Politics*, 6(3), 96-103. <https://doi.org/10.1162/glep.2006.6.3.90>.
- Victor, D. (2011). *Global Warming Gridlock: Creating More Effective Strategies for Protecting the Planet*. Cambridge University Press.

- Victor, D., Geels, F., & Sharpe, S. (2019). *Accelerating the low carbon transition: the case for stronger, more targeted and coordinated international action*. Energy Transitions Commission.
<http://www.energy-transitions.org/content/accelerating-low-carbon-transition>.
- Vihma, A. (2014). Climate of Consensus: Managing Decision Making in the UN Climate Change Negotiations. *Review of European Community and International Environmental Law*, 24(1), 58-68. <https://doi.org/10.1111/reel.12093>.
- Wappelhorst, S., & Cui, H. (2020). *Momentum: Global overview of government targets for phasing out sales of new internal combustion engine vehicles*. ICCT.
<https://theicct.org/growing-momentum-global-overview-of-government-targets-for-phasing-out-sales-of-new-internal-combustion-engine-vehicles/>.
- White House. (2022). *FACT SHEET: President Biden to Galvanize Global Action to Strengthen Energy-Security and Tackle the Climate Crisis through the Major Economies Forum on Energy and Climate*. Statements and releases. Whitehouse Government.
<https://www.whitehouse.gov/briefing-room/statements-releases/2022/06/17/fact-sheet-president-biden-to-galvanize-global-action-to-strengthen-energy-security-and-tackle-the-climate-crisis-through-the-major-economies-forum-on-energy-and-climate/>.
- World Bank. (2021). *The Global Facility to Decarbonize Transport GFDT. Supporting Countries in their Decarbonization Initiatives*. World Bank.
<https://thedocs.worldbank.org/en/doc/e14c76f49f8907a58fbfe039fc51d8d3-0190072021/original/GFDT-Concept-Note.pdf>.
- World Bank. (2022). *Global Facility to Decarbonize Transport*. World Bank.
<https://www.worldbank.org/en/topic/transport/brief/global-facility-to-decarbonize-transport>
- World Economic Forum. (2021a). *G7 Economic Data*. WEC. <https://www.worldeconomics.com/Regions/G7/>.
- World Economic Forum. (2021b). *G20 Economic Data*. WEC. <https://www.worldeconomics.com/Regions/G20/>.

PARTICIPANTS



NDC ASPECTS project has received funding from the European Union's Horizon 2020 Research and Innovation programme under grant agreement No 101003866



NDC ASPECTS

www.ndc-aspects.eu

@ndcaspects



@ndcaspects

