

# T4<2°

Transport  
For Under  
Two Degrees

The Global Foresight Project  
on Transforming Mobility  
by Mid-Century

## Transport for under two degrees

A synthesis of qualitative expert interviews on transforming mobility by mid-century



Federal Foreign Office

implemented by:

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für Internationale  
Zusammenarbeit (GIZ) GmbH

WORLD  
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Verkehrswende



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# 1 T4<2° – The global foresight project on transforming mobility by mid-century

## Project Background

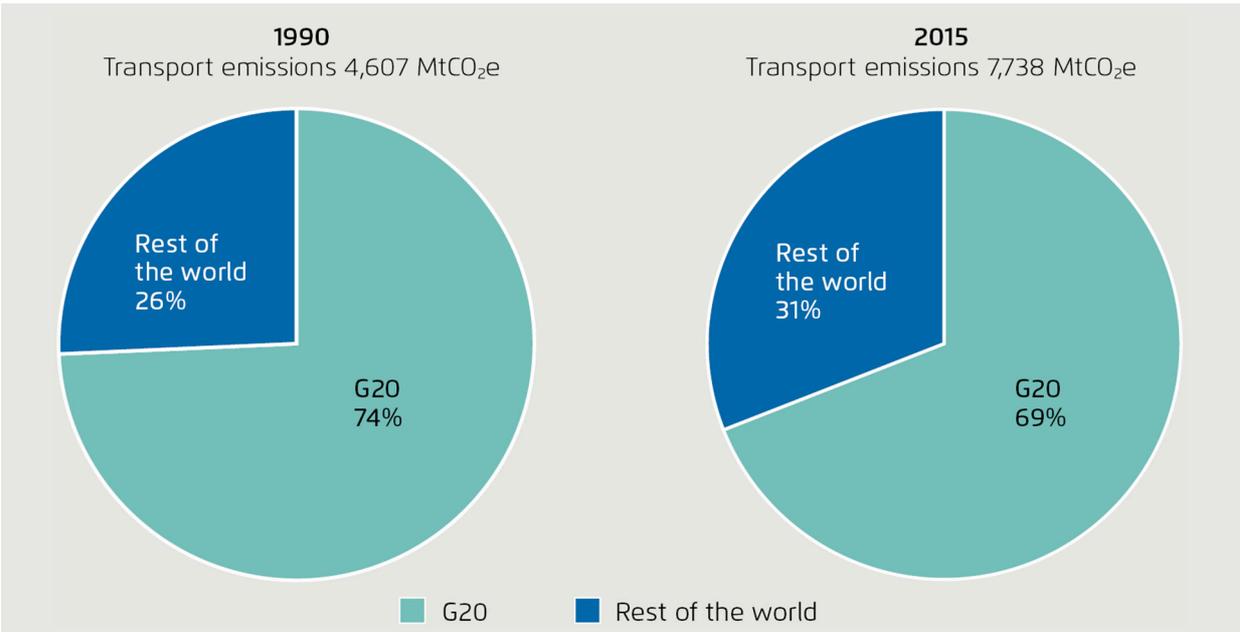
Hardly any global issue has attracted as wide-spread attention in the past months as the need to limit climate change and reduce global greenhouse gas emissions. Transforming the way that energy is used is crucial for achieving this goal. While the global energy transformation is in full swing in the electricity sector, a lot remains to be done in other sectors.

Being responsible for approximately one-quarter of the world’s greenhouse gas emissions and the consumption of more than half of the global oil demand, the transport sector is one of the biggest energy consumers and thus the largest emitters of greenhouse gases (GHG) worldwide. Therefore, the sector inevitably figures

prominently in efforts to transform the energy economy and protect the climate. A low-carbon transformation of the global transport sector is the next necessary step in the global energy transformation.

At the same time, by enabling the mobility of goods and people, transport fulfils a crucial economic and societal role. Given this cross-cutting nature of transport and mobility, an effective decarbonisation of the sector can only be achieved by co-ordinated international efforts. International politics has to create the right framework conditions in order to enable and stimulate said transformation. Need for action goes far beyond transport and energy policies. Rather, it touches upon all fields of international politics and there are various trade-offs. Solving these challenges requires suitable conditions that need to be established on the highest levels of international politics.

Figure 1: CO<sub>2</sub> emissions from the transport sector 1990-2015



Source: Authors’ illustration based on data from IEA (2018)

Most of today’s transport-related GHG emissions are produced in G20 countries. But the transport systems of emerging and developing nations are currently undergoing rapid growth and soon their emissions will most likely be rising faster than those of industrialised countries (figure 1).

The OECD International Transport Forum estimates that by 2050 global transport emissions will grow by around 60 per cent unless immediate measures are taken.<sup>1</sup> In the absence of such measures, the international community threatens to fall dramatically short of the Paris Agreement’s 2015 goal of limiting global warming to well below 2°C (figure 2) as well as the aspirations set by the United Nations’ Sustainable Development Goals.

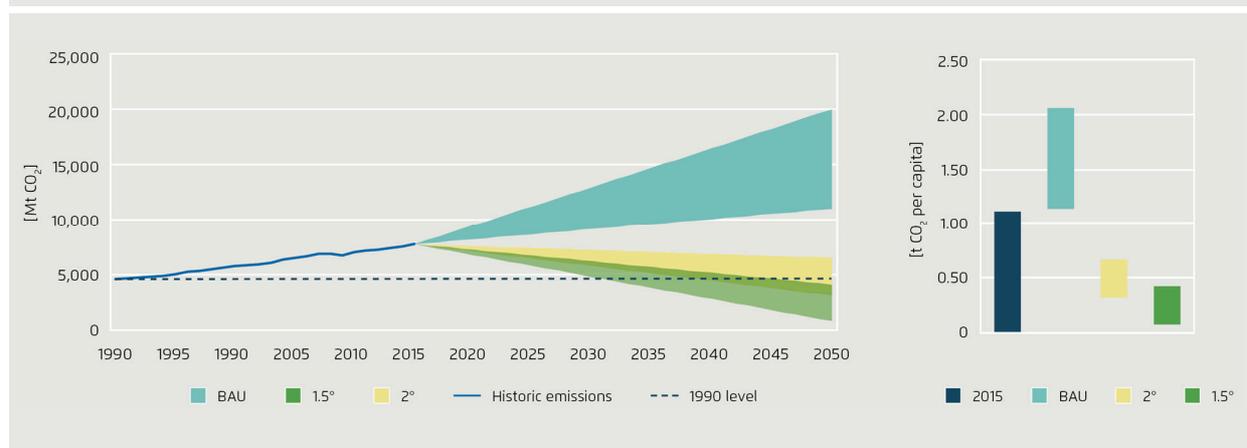
The transport sector thus plays a major role in clean-energy initiatives and government actions to fight climate change. However, protecting the

climate is just one part of the equation. Ongoing urbanization has left cities all around the world with massive levels of congestion that have brought transport systems quite literally to a halt. Meanwhile, a lack of mobility options in rural areas imperils societal and economic growth. New digital technologies will provide some solutions, but they will also bring disruptive changes. Addressing them gives rise to an unprecedented political undertaking, one whose scope goes well beyond the transport sector. The geopolitical re-configurations and shifts in global power that may result, will themselves pose new challenges to transforming mobility.

### Project Approach

In the light of these major future challenges, the German Federal Foreign Office has commissioned the project “T4<2° – The global foresight project on transforming mobility by mid-century” to develop global recommendations that promote a sustainable climate-friendly transport

Figure 2: Transport sector emissions: business-as-usual development and required reductions under 2°C and 1.5°C scenarios



Note: Simplified illustration based on historic levels and projected 2050 levels. Individual scenarios are likely to peak around 2020 and then decrease emissions at higher rates afterwards. Source: Authors’ figure, historic emissions based on data from IEA (2018), projections based on data from Gota, et al. (2018).

1 OECD/ITF (2017).

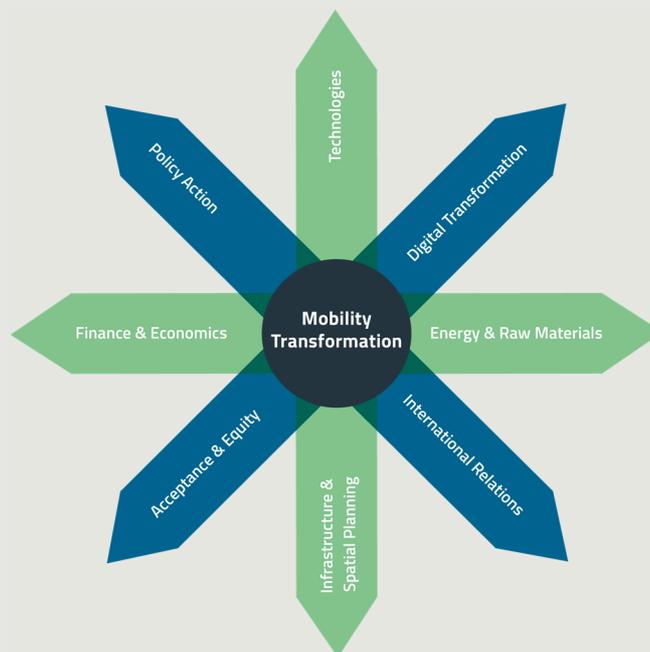
sector. The project is being carried out by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), the World Economic Forum (WEF) and Agora Verkehrswende. T4<2° aims to develop recommendations for action with methods of strategic foresight in a three-stage process. So far, the participating researchers have conducted a qualitative survey with an international and interdisciplinary group of more than 60 experts, which acts as a context-mapping for the further phases to come. Based on these qualitative findings, the goal is to formulate hypotheses about potential developments in the transport sector and their interactions with politics and other areas of the economy (transport, energy, housing, manufacturing, employment, national security). In a second step, the researchers will employ a Delphi technique to verify their hypotheses with several hundred international

experts. In the third and final step, they will draw on their previous insights as they dive deeply into the context of selected countries and regions in order to develop policy recommendations for foreign policy, diplomacy and international co-operation to create conditions that are favourable to a low-carbon transition in the transport sector.

## 2 Insights from the experts: How to transform mobility by mid-century?

This paper represents an interim report, displaying some preliminary results from the first of the three project phases. The goal of the context mapping is to give an impression of the

Figure 3: Context mapping on transforming mobility



Source: Author's figure.

relevance of certain topics, challenges, and solutions revolving around the transformation of the transport sector. Thus, the expert interviews are meant to serve as a “listening in” to the sector, in order to be able to choose target areas for further investigation. The results of the interviews have proven to be a very valuable insight into a highly complex sector, which is currently facing large disruptions and an uncertain future. The interviews were conducted using a pre-structured survey that clusters its questions into eight themes (figure 3) revolving around the main topic of mobility transformation. Consequently, the following findings are also divided into eight subtopics and sum up the most prominent results and insights.

Before talking about any of the specific topics mentioned above, the experts were asked to give a brief summary of the main challenges that actors world-wide are faced with when trying to decarbonise the transport sector and promote a sustainable mobility transition by the middle of this century. The general opinions were very much in agreement that, until now, the pace of the transition is not in line with the goals set by the Paris Agreement and will most likely fall short of trying to reach full decarbonisation by 2050. Whilst the reasons for this may be numerous and complex, the way forward is clear: the sector must undergo a systematic change involving all key actors, state levels and countries. There is no single pathway or solution to carbon neutrality and the multitude of measures needed may include ones that are currently controversial.

A further general point that was stressed in many interviews, is that the transport sector cannot be seen as an isolated field of action but must be integrated into measures involving various other sectors. Given the global nature of the sector, an effective transformation of transport

relies on intense international co-operation as well as ambitious action in policy fields that are transnational in nature, such as trade and standardisation. Examples for the necessary integration are the coupling of the mobility transformation with the electricity sector regarding the electrification of future transport systems or the inclusion of transport into spatial planning and the future of urban land use. In the words of one expert, we need to *“look at transport as a connector, rather than a sector”*.

Two key questions which arise from the results of this general introduction to the survey are:

1. By when will the global transport sector be decarbonised and which consequences will this have for international politics?
2. What are the major challenges in transforming transport?

Both questions are crucial to setting the timeframe and main fields of action when trying to formulate recommendations of action.

## 2.1 International Relations

With regard to international relations, the research focuses on what role various actors at different state and institutional levels play in the transformation of the transport sector. Also, it addresses the influence of climate-friendly mobility on geopolitics and international trade, as well as the impact a transition could have on global trade flows and power distributions.

Key findings were that, while everyone acknowledged the significance of international agreements and supranational institutions in this cause, a majority of participants stressed the importance of cities and local governments in transforming mobility. Some also argued that cities and local authorities should be given more

power and resources for transport-related issues, which leads to a discussion about subsidiarity on different state levels. This is not least due to the paramount importance of questions relating to infrastructures and spatial planning (see section 2.7). On the other hand, a further aspect was the importance of strengthening the international level through new global policies and standards, whilst promoting best-practice examples within the international community. This includes changes in the way how existing institutions such as the International Maritime Organisation (IMO) or the International Civil Aviation Organisation (ICAO) set incentives for the implementation of certain technologies or business models.

Concerning geopolitics and international trade, one of the key questions that arises is which country or region will be the most decisive for the future of transport. The overall opinion was that the transport transformation will have a strong, potentially destabilising impact on oil-exporting countries and countries with a large automotive industry, whereas countries or regions that are rich in resources needed for future mobility concepts have the potential to change the current balance of power on the global goods and energy market. These findings are in line with prior research on the geopolitics of the energy transformation<sup>2</sup> with the role of incumbent industries (such as automotive) being an additional layer of consideration. This topic also links with the trade in energy and raw materials and will therefore be addressed in the further course of this report.

Another important point regarding the development of trade and goods flows was the assumption that climate change is likely to impact global trade routes. Examples for this are:

- a) the Arctic Circle will become ice-free and shipping routes between Europe and east Asia will be shortened, thereby decreasing energy demand but also bypassing the Middle East
- b) draughts will become more severe in Middle America, reducing the capacity of the Panama Canal, making trans-continental railway links in North America more important and thereby decreasing emissions from transport on respective routes
- c) both effects would lead to a reduction of revenue streams from the Suez and Panama Canals, as well as ports in the Middle East and in the Caribbean, threatening those economies.
- d) Generally, experts widely acknowledge the pivotal role of international trade policy to influence the transformation of transport. On the one hand, trade regimes shape the demand for transport. On the other hand, trade policy has the potential to stimulate innovation in low-carbon transport technologies through measures such as border-adjustment taxes and import standards.

These statements underline the complex cause and effect relationships between a globalized economy and the impact it has on our climate and eco-systems, whilst stressing the importance of further international regulations and pricing schemes that are adapted to the complexities of our current international political landscape.

## 2.2 Energy and Raw Materials

As mentioned before, the task of decarbonising transport is a cross-sectoral affair that has many different fields of action. However, one of the largest undoubtedly revolves around the energy economy, as this sector is currently also going through fundamental change towards a fossil-

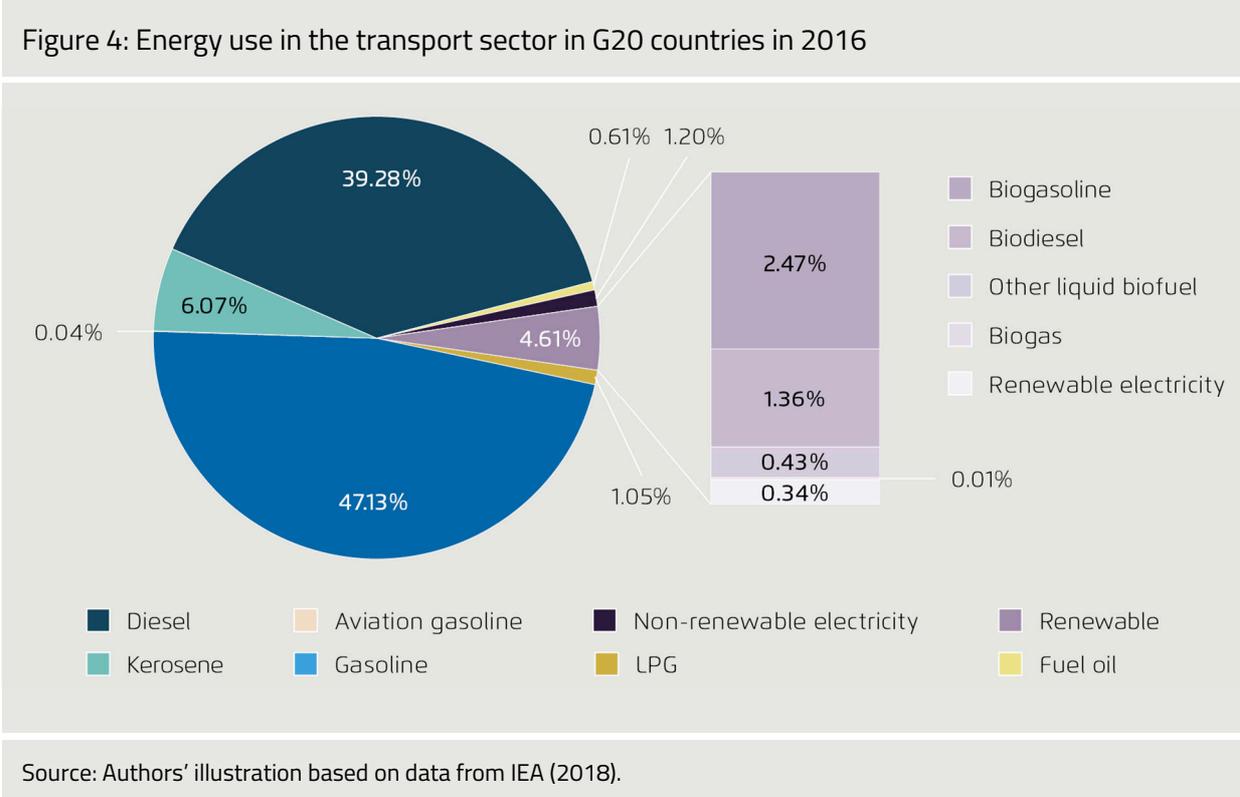
<sup>2</sup> As pioneered by IRENA (2019) and Bazilian et al. (2019).

and carbon-free future. Combined, transport and electricity/heat generation make up two thirds of global CO<sub>2</sub>-emissions and are equally responsible for almost the entire global growth in emissions since 2010.<sup>3</sup> Thus, finding synergies between the mobility and energy transformation was one of the main talking points when discussing energy and resources with the survey participants. Even though one expert also stated that in terms of energy demand, *“less is more is the ultimate synergy”*.

A large challenge in this context is the low share of renewable energies used in the transport sector compared with other energy sectors such as power or heating, whereas over 95% of the energy used in G20 countries in the sector is fossil-based (figure 4). The consensual opinion regarding the reason for this low share in carbon-

neutral energy sources was that the current worldwide capacity of renewables is insufficient to fit the targets of electrification of transport. Therefore, development of further renewables is a key factor. Similarly, the use of synthetic fuels created from renewable electricity is seen by many experts as a good opportunity to decarbonise transport applications that cannot easily be electrified. This includes the use of fuel cells to create hydrogen or other ways to create fuels (Power-to-X).

The other major challenge to combine the two transitions that was mentioned by many experts is grid development and flexibility. The current power grid capacity is not regarded as sufficient to support large scale electrification and the decentralised nature of energy production and usage makes distribution very difficult. The



<sup>3</sup> IEA (2017).

interviewees agreed that innovation regarding energy storage is needed to meet these challenges and that both batteries and hydrogen are the biggest innovation fields in this context. Another opinion was that the use of digital innovation can be helpful by creating algorithms that can predict the distribution of energy in order to generate a leeway for e-mobility in electricity grids.

On the topic of resources and raw materials, the experts agreed that there must be more international awareness of potential impacts around an increased demand in materials such as rare earths, cobalt or nickel. Although the demand of these materials will increase and there may be shortages in the short term, a majority of experts consider the potential of the aforementioned materials to become a geopolitical power factor and create resource curses similar to oil to be overstated. In the meantime, regulation of sourcing needs to happen regarding the working and safety conditions of mines, e.g. in Congo.

Currently, many G20 nations and other countries around the globe are placing a focus on expanding the deployment of biofuels. Consequently, the survey was also geared towards determining the general expert opinions about this development. Among some experts there was a strong consensus that biofuels are not sufficiently sustainable as a large-scale future energy source and hence are a distraction as a fuel for passenger cars and light-duty vehicles. Others expressed the opinion that biofuels might play a role as a blend for aviation and maritime fuels but must aim for a net-zero or positive impact. Furthermore, some experts expressed scepticism about the question of fuel versus food and the sustainability of biofuels regarding land-use and priorities towards food. The discussion shows that, while there is no definite opinion for

or against biofuels, the pool of experts brought forward a certain amount of scepticism and reservations concerning their large-scale deployment in the transport sector.

To summarize the topic, energy and resources are recognized as one of the key issues for the transport transformation. Moving towards renewable energies will cause major transformations in global energy flows, whilst grid development and an increase in the capacity of renewables represent the most challenging aspects concerning the coupling of the energy and mobility transformation. In general, this means that, as a main goal for the transport sector, *“energy intensive mobility can and must be discouraged”*.

### 2.3 Digital Transformation

No current technological development has such far-reaching effects as digitalisation, which goes far beyond the transport sector. Consequently, we must ask, what role new digital developments and innovations are expected to play in transforming mobility. For a large number of experts, digitalisation in the transport sector is closely linked to “CASE mobility” (connected, autonomous, shared, electric), whilst self-driving vehicles most certainly represent one of the most discussed and controversial topics in the context of this survey.

Some experts also mentioned aspects like the beneficiaries of digitalisation in Mobility as a Service (MaaS), whilst others stressed the importance of international standards for communication between vehicles and transport infrastructure or international standards for ticket-pricing and mobility-app-usability across public transit networks. A further cross-sectoral topic that was mentioned by a number of experts was the rapid development of 3D-printing and its potentials to transform production and

value-chains in industries relevant to the transport sector, thereby also upending traditional trade patterns and potentially harming revenue potentials of transport hubs.

Regarding adequate governance and regulation of digital transformations in the transport sector, some experts adopted a very liberal approach by stressing the importance of letting the transformation happen without the need for many new policies and regulatory frameworks. However, the majority pointed out that a lack of policies might lead to a chain of undesired effects ranging from the emergence of monopolies and a lack of competition to the cannibalization of public transport or walking and cycling. Further concerns were aspects like data security or an increase in mobility gaps and social inequality. Mitigating those harmful consequences of digitisation, however, is only expected to be possible by creating and effectively enforcing international standards as well as establishing respective governance structures.

On the other hand, digital innovations in the mobility sector were seen as most promising, if they are combined with policies that encourage pooling or sharing of vehicles, thus making it easier to avoid car ownership and dependency.

A large number of experts devoted much attention to the possibilities and risks of autonomous vehicles (AVs) and this can certainly be seen as one of the most prominent aspects regarding the digitalisation of the transport sector. At the same time, it is still one of the most uncertain and controversial topics which has the potential to revolutionise our transport system with a variety of different pathways and outcomes. A majority of survey participants had either moderate or strong opinions on the future of AVs and a frequently mentioned aspect was the so-called "heaven or hell"-scenario which describes the potential for

AVs to either reduce vehicle miles travelled (VMT) when used in sharing- and pooling-concepts or increase VMT and urban sprawl, when used privately. *"Of course, the holy grail [...] is the completely autonomous vehicle and it can either be a chance for sustainability or turn out to be disadvantageous, depending on the decisions made now"*. Consequently, important questions regarding AVs are:

- 1 When will AVs be market ready?
- 2 Will they all either be shared and pooled or privately owned?
- 3 Will they increase urban sprawl and further undesired effects?
- 4 How can they be helpful in decarbonising the transport system?

The answers to these questions are closely linked to establishing the right regulatory framework for automated driving, which was a frequently mentioned necessity for many experts, in order to ensure an actual benefit for the mobility transition.

All in all, these findings show that digitalisation is a prominent factor for the future of the transport sector that still poses many uncertainties and requires a well-designed policy framework in order to actually benefit the mobility transition and the decarbonisation of the sector.

## 2.4 Finance and Economics

Economic questions and financing challenges are fundamental to many areas of the global transformation of the transport sector. Whilst international cash-flows and the access to capital have a large impact on the emergence of new mobility services and the financing of transport infrastructure, the discussion around a global mobility transition is always linked to questions about economic viability and employment prospects.

This issue is even more pressing in current times of a strained international economy that is suffering from a rise in protectionism and may be facing the possibility of a global recession.

A key point concerning this topic that sparked off some controversy among the experts was how countries could break the link between economic growth and increasing transport emissions. Within the pool of experts, there was a certain degree of agreement that this step is necessary, but there was also a number of experts that regard a decoupling as impossible, because the two fields of growth are too closely connected. Others argued that the question is quite delicate, because it implies a necessity for countries to decouple economic growth and transport volume, even though certain regions heavily depend on transport in order to accelerate their national economic growth. The participants who argued in favour of a decoupling adopted the thesis that the link can only be broken by shifting to more efficient modes of transport on a broad scale, thus reducing vehicle kilometres per person and freight unit, without impeding economic growth. In this context, a number of experts pointed out that the current level of globalization is a huge challenge for transport sustainability and more efforts should be made to encourage local approaches towards moving goods.

A consensual opinion was that the transport sector will undergo a fundamental transition that sees radically new business models emerging. This will impact various countries to differing degrees and the transition will probably be easier in countries, where efforts for decarbonisation do not conflict with economic interests. The rise of new business models was often seen in correlation with a shift in investment from established technologies to more sustainable mobility and infrastructure, although the challenge that one

expert pointed out here is that the current finance system is often geared towards high capital expenditure projects, neglecting the need for investment in walking and cycling or basic public transport. *“There is no shortage of finance, only a shortage of profitable projects”*. This statement describes the general controversy about the role of the private sector in transport and infrastructure finance, where aspects of cost/benefit can often deviate from the achievement of decarbonization goals, or, to put it in the words of another survey participant: *“The financial sector is interested in money, not morality”* and regarding the role of the industry in general, *“existing companies have trouble to disrupt themselves and come up with different solutions”*.

In conclusion, economic aspects are imperative to a successful mobility transformation, yet it has become obvious that a certain amount of institutional steering is needed to make sure that investments in sustainable mobility projects are not limited by calculations of cost and benefit and need the support of both the private and public sector. Through multilateral development banks and development schemes, international co-operation can stimulate necessary shifts and steer the industry in a direction favourable to a transformation of transport.

## 2.5 Technologies

In order to reduce energy consumption without limitations to mobility-access, a fundamental change in people’s mobility behaviour is essential. However, covering the remaining demand with carbon-neutral energy is primarily a technological challenge. Consequently, it was imperative for this research to ask, which vehicle and drivetrain technologies the participants currently regard as most important for changes in mobility and transport.

The majority of experts spoke in favour of continuing to develop and support a broad range of powertrains and fuels depending on the usage scenario and type of vehicle. The recurrent theme was that there is no single solution for the transport sector. Therefore, it is important to stay open-minded on the technology, but not on the standard – which should be zero-emission. A further recurrent point was that different solutions are needed for land-based passenger and freight transport as well as aviation and shipping.

Sharing models and MaaS were very recurrent themes too, which were often mentioned in connection with the necessity for good policies regarding non-car transport and which also drew cross-references to the topic of digitalisation.

A further cross-reference was often made concerning the aspect of electrification, as the controversy surrounding the implementation of electric vehicles due to a lack of infrastructure or high cost of building infrastructure was often mentioned in context with a better coupling of the transport and energy sector. Also, electrification should be based on renewables and those agendas must support each other.

Further controversies and discussions revolved around the implementation of hydrogen and its various usage scenarios. Some experts stated that hydrogen will most likely not be competitive for the next 10–20 years and battery-electric vehicles are therefore the best option we have right now, whilst other experts were convinced that hydrogen will play a large role for heavy goods vehicles, shipping or aviation. Concerning battery-electric vehicles, many experts stressed the importance of moving forward on the development of new battery generations and more efficient ways of energy storage in general, whilst topics such as circular economy and the recycling

of batteries will be of great importance as the scale of EV-production continues to expand.

What became clear is that technology on its own will not solve the transport sector's decarbonisation challenge and, whilst many current transformations in the transport sector are technology-driven, it would be foolish to ignore non-technological solutions such as active transport modes, or as one expert put it: "*Much of the mobility sector is seeking ways to make car-dependency sustainable without questioning car-dependency itself*". Additionally, the benefit of certain technologies cannot be disconnected from their viability as a tool to stimulate innovation and competitiveness of economies. It is to be expected that industrial capacities in innovative technologies related to transport (such as battery storage) will become a decisive locational economic factor in the next decades and it should therefore be a core element of regional industrial policy, for example within the European Union.

## 2.6 Infrastructure and Spatial Planning

Tomorrow's transport infrastructure will consist of more than roads, railways and bridges. It will also include electric vehicle charging points, filling stations for alternative fuels, as well as various types of digital infrastructure like high-speed internet and communication technologies. Investments in these future infrastructures have the potential to accelerate the transformation or to create lock-in effects for the existing transport systems, which could impede new pathways and make sustainable development even more expensive and difficult.

Consequently, mobility and transport are heavily influenced by infrastructure and spatial planning, both of which are subject to political decisions and processes. Thus, the study's main focus regarding this topic was to ask what changes to

existing infrastructures are necessary for a successful mobility transformation and to what extent new modes of transport or new mobility concepts can be helpful in bringing about these changes.

A consensual opinion was that the allocation of public space plays a very important role with regard to land use and transport. These two fields should be linked in order to create cities that grow around multimodal transport hubs. Cities in developing economies were seen to have an advantage in this area, as they do not suffer from locked-in land use planning but are still flexible and have a lot of potential for the development of sustainable space-efficient transport. At the same time, these cities must act now in order to set the right pathway and avoid choices and investments that encourage car-dependent behaviour and infrastructure.

Another recurrent opinion was that it needs strong political courage to rethink personal mobility and (car-based) transport. *“The biggest obstacle is not consumer preference, but vested interest by existing industries”* and the strategic long-term planning approach that is needed for climate-friendly infrastructure and mobility will not be delivered by the markets alone but must be backed by strong policies and efficient land-use planning. Examples for this are making sure that public transport remains the backbone of urban mobility systems or that barriers for EV-infrastructure development are eliminated as much as possible.

Further keywords that were mentioned in connection with future land-use planning involved dense, space efficient, mixed-use and human-centred urban development as well as the need to strive towards integrated, connected and livable cities. Furthermore, many experts see the

need for cities to reallocate public space that has so far exclusively been used for individual motorised transport. *“Much of the existing overbuilt capacity for motor vehicles can be refitted for more sustainable purposes, which do not solely have to serve the transport sector”*.

Concerning the influence of new mobility solutions on existing infrastructure, an important point that we need to ask ourselves is in what way they can contribute to the decarbonization of the transport sector without jeopardizing existing sustainable solutions such as public transport or walking and cycling. In this context, some experts were keen to stress the importance of the right policy framework for new technologies such as autonomous vehicles, which also have the potential to re-shape the existing infrastructures depending on their use and integration into the transport system.

These findings lead us to the question we must ask regarding the development of transport and infrastructure over the next decades: whether transport in both urban and rural areas will be dominated by individually-owned vehicles, shared mobility services or public mass transport. For it is this question which will also determine the future development of transport infrastructure and spatial planning and that highlights the importance of local planning initiatives and projects.

While all these questions are primarily local in nature, the international sphere plays a role in solving these challenges, too. As the example of the transition in the electricity sector with institutions as IRENA shows, a successful transformation is only feasible when accompanied by an effective, intense, cross-sectoral and international exchange of experience and best practices as well as co-creation among different

geographies. International politics has the responsibility to provide adequate spaces in which this kind of exchange can take place.

## 2.7 Acceptance and Equity

The transformation of the transport sector can only succeed if it is socially accepted by all members and groups of society. Above all, changes mean changes in people's expectations and behaviour, such as their mobility behaviour or consumer habits. In addition to that, the current discourse around equity in transport often involves the question of how to ensure a just transformation for all members of society, minimizing mobility gaps and ensuring accessibility. At the same time, the current setup of the transport sector has established value creation chains that permeate deeply into a country's economy and that in many regions constitute the single most important economic factor, determining employment and welfare for large parts of the population. Given that all parts of any given society will be affected by the changes that are necessary, the effects of a transformation of the transport sector can challenge the stability of all countries. Recent examples such as the mass protests in Chile which have been caused by a raise in Metro fares, in Ecuador due to an increase in fuel prices or the "Yellow Vest" movement in France show, how issues related to transport can be a catalyst, if not even the very reason, for deep-reaching upheaval that can topple governments.<sup>4</sup> Equally, these motives can be exploited by populist forces that convey anti-liberal agendas and threaten a rules-based political order.

Consequently, the experts were asked how the decarbonisation of transport can increase social justice and, at the same time, how actors can make sure that the measures, policies and actions involved in this task are publicly accepted

without becoming a disproportionate burden for any part of society.

Concerning social justice in the transport sector, a frequently-mentioned aspect was the positive effect that sustainable transport can have on cities and the quality of life within them. Especially since studies show that the poorest members of society are often faced with the highest negative impacts of transport regarding air and noise pollution, as well as a lack of access to transport, social justice has become an important topic in the sector.<sup>5</sup> On the other hand, one expert pointed out that there is still a need for a clear definition of social justice in transport - especially regarding pricing. *"Making mobility cheap is not the same as making accessibility cheap"*. Therefore, many experts also pointed out the positive effects that a just (public) transport system can have regarding subsidies for lower income groups who are affected by new policies or who would be able to avoid car-dependence through better access to affordable public transport. In this context it is imperative to know, which measures of transport transformation benefit which groups of people the most and which sectors of society might be disproportionately challenged by a potential new policy or mobility gap.

Regarding the acceptance of new transport modes and policies, many interviewees highlighted the importance of convenience when promoting sustainable transport options. Ideally, there needs to be a service for every type of budget, whilst shifting from a private car to sustainable transport modes has to come with benefits, where people see advantages for them to change their behaviour. This is regarded as a key step towards the necessary acceptance for transformation needed in society.

4 BBC (2019a); BBC (2019b); The Guardian (2018).

5 EEA 2018

Some experts also highlighted the importance of teaching about behaviour change in schools, because recent climate awareness amongst young people shows that future generations will play a large role in shaping and promoting more sustainable mobility behaviour.

Further topics that were mentioned included transport-related gender-inequalities, where some participants made the point that gender issues are not fully understood and represented in the discussion but are very relevant in certain regions or countries.

All in all, it has been demonstrated that the question of how to achieve a just transformation is as pressing in transport as it is in other sectors such as energy. Affordability, accessibility and convenience are seen as key factors when ensuring public acceptance for new policies and measures, thus creating an ideal foundation for the necessary behavioural change of society towards sustainable mobility models. Besides these issues related to the very design of transport policies, the abovementioned questions also pertain to more general considerations of equality, participation, and civil rights protection.<sup>6</sup> Thus, the global transport transformation needs to be accompanied by a values-based international order that allows for the necessary shifts to take place in a sensible and responsible manner.

## 2.8 Policy Action

Many aspects of the topics mentioned in the previous sections include a variety of recommended policy actions. From the statements of the experts it becomes evident, that any measures taken toward transforming transportation are inevitably linked to governance and policy action. Consequently, policy action was

one of the most-discussed topics during the interviews that made up the data-input for this survey and will therefore be addressed in appropriate detail.

To begin with, it must be stated that a long-term task such as the transport transformation requires cohesive policies. This should involve the coordination of policy-makers at all levels of government from a supra-national level to local municipalities. With this in mind, the participants were asked, which policy instruments or programmes are most important for transforming mobility. Apart from this being quite a broad question, it was interesting to see that the majority of experts did not pinpoint a specific instrument but argued that all instruments are important and necessary to achieve the desired impact on a global scale. On a local scale however, the experts shared similar opinions about the fact that instruments need to be tailored specifically to various regions, as some regions and countries may work better around a regulatory-based policy framework, whilst other regions are expected to achieve better results with an incentive-based framework.

One policy that was mentioned more often than any other was pricing. The general opinion was that the best chance to make a lasting impact on the transport sector will involve getting the pricing right on both local, national and international levels. This includes measures like a carbon tax, road pricing (congestion charging, user/polluter-pays principle), a bonus/malus system, parking, as well as subsidies for public transport and is seen as a valuable tool to make sure that the cost of various transportation modes is reflected adequately by taking their level of pollution, emission and other external costs into account. Furthermore, *“these measures need to ensure that*

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6 Ranft et al. (2019)

*the distribution of the impact is addressed and doesn't end up being a major strain for people that are already economically challenged”.*

A further point that was made concerning policy instruments was that the effectiveness and desired impact should determine the type of instrument that is implemented. In general, the experts agreed that the main goals of policies should be to encourage sustainable forms of transport such as pooling, sharing, public transport and electrification, whilst discouraging the use of personal motor vehicles and avoiding car-dependency. In addition to that, policies should be implemented to steer new technologies such as self-driving cars towards a sustainable usage scenario, thus preventing possible negative effects.

Furthermore, participants pointed out that all these efforts should be part of a broader policy framework that goes beyond the transport sector and encourages behavioural change across a wide range of sectors and fields of action. This links in to the frequently mentioned thesis that we need stop seeing mobility as an individual policy and integrate mobility into other policies in a much more effective way on all political levels. Here again, the value added by the international exchange of experiences and joint policy creation becomes evident.

### 3 Transport for under two degrees – The way forward

The findings from the expert interviews show that decision makers world-wide are currently facing a monumental task of the utmost importance and urgency – one that requires fundamental action, which cannot be postponed any longer. The change needed in order to reach a full decarbonisation of the transport sector by 2050 should not be limited to making current transport technologies more efficient but must aim for a general paradigm shift in the way mobility is planned, run and used in all fields of economy and society. Furthermore, the interviews have confirmed that the measures needed for transforming mobility cannot be viewed separately from each other but must be part of an integrated approach involving a variety of different sectors and actors. This will require a comprehensive policy framework across all state and political levels as well as a large amount of political courage to implement these measures. Furthermore, it will need a certain level of public acceptance and a basic willingness for behavioural change, which has yet to develop within large parts of society. Creating the right frameworks for this in order to take advantage of the benefits on an international level is as much a task for diplomacy and international co-operation as it is to be vigilant about the risks that the transformation yields.

For “Transport for under two degrees” this means that the upcoming two phases of the project can contribute to setting an outline for this necessary transformation. After having established the main fields of action as well as the most pressing topics concerning the mobility transformation, the researchers have now developed a number of questions and hypothesis, which will be verified using a Delphi survey.

High-ranking stakeholders and experts from politics, business, academia, as well as civil society will be asked about their opinion on the matters at hand in an on-line survey. The results gained from several hundred participants shall serve as a basis on which the researchers will then formulate global as well as location-specific recommendations for action. The interviews have confirmed that this regionalisation is highly necessary and relevant, as every local context also requires local policies that are tailored to the specific needs and situation of the region.

The first results of T4<2° will be published in March 2020 during the Berlin Energy Transition Dialogue (BETD). Please visit <https://2020.energydialogue.berlin> for detailed information about this high-level event. The final results of T4<2° will be presented in June/July 2020 and are aimed at making a major contribution to the discussion about the transition in the transport sector.

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For Under  
Two Degrees

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on Transforming Mobility  
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