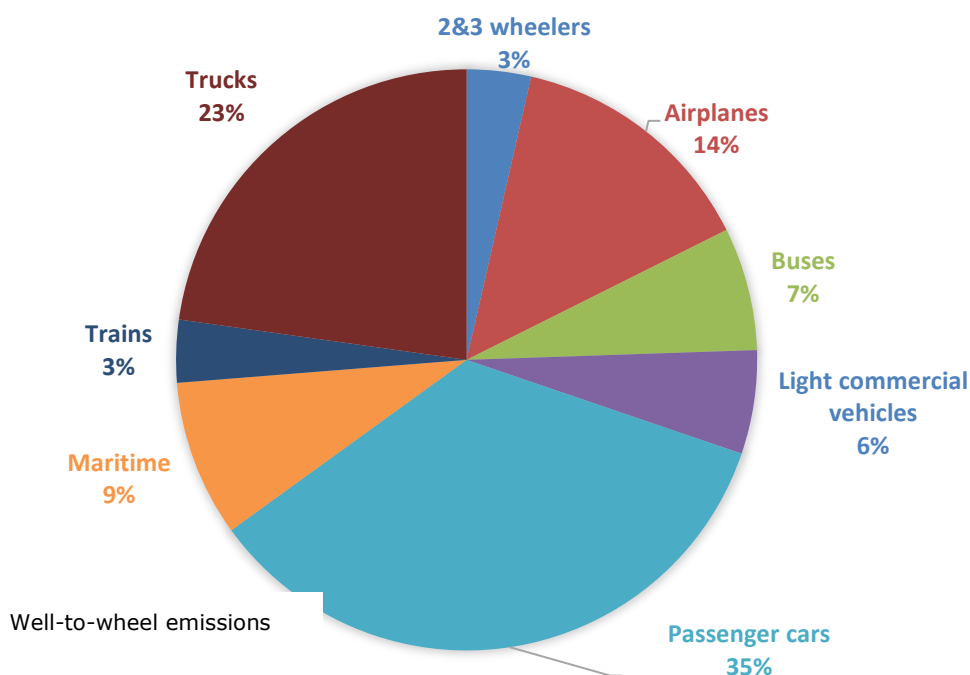


G20 High-level Principles for Transport Decarbonisation

The world continues to experience more extreme weather events, including devastating floods, record-high temperatures, and extensive wildfires¹. As well as the catastrophic loss of life, livelihoods, and habitats, these events have substantial economic impacts. Transport accounts for 23% of pre-Covid-19 global energy-related CO₂ emissions², making it a vital sector to decarbonise.

Continuing on the current policy pathway could see CO₂ emissions rise from 7.8 giga-tonnes in 2022 to 8.3 giga-tonnes in 2050³. Despite a dip in emissions during the Covid-19 pandemic, emissions from the transport sector continue to rise, driven by demand which is forecast to roughly double by 2050 for both passenger and freight transport, which will indirectly increase demand for energy to meet this need. Whilst most governments have put in place policies to tackle emissions from transportation, the sector is currently not on track to decarbonise in line with the goals of the Paris Agreement.⁴

GLOBAL CO₂ EMISSIONS FROM TRANSPORT



The transport sector is a significant part of the global economy, acting as a major facilitator of increased accessibility and influencing the economic and social outcomes of individuals. Transport is crucial to the three pillars of sustainable development: the economy, the

G20 High-level Principles for Transport Decarbonisation

environment and society.⁵ Transport activity is heavily influenced by trends in population, economic growth, and settlement patterns. It is vital that policy pathways and levers are identified that enable economic development, alongside decarbonising the associated transport activity, also accounting for the needs of different regions.

Decarbonising the transportation sector can go hand in hand with development, and deploying clean technologies presents opportunities for innovation, jobs, and economic growth. As the transport sector becomes increasingly electrified, grids must be prepared for increased demand for clean electricity. As demand for clean fuels for difficult-to-decarbonise transport modes grows, further innovation is required in the energy sector to produce zero-emission fuels.

The Covid-19 pandemic has highlighted the importance of strengthening the resilience of the transport sector. The transport sector's centrality to the core areas of human life makes it especially vulnerable to global crises. Therefore it is vital to build transport systems that are resilient, future-proof, and can withstand extreme weather resulting from climate change, pandemics, or energy and supply chain crises.

The clean energy transition offers opportunities to strengthen the resilience of the transport sector. The transport sector has the highest reliance on fossil fuels of any other end-use sector⁶. Improving the energy efficiency of the transport sector and transitioning away from fossil fuels and towards renewable energy will have the co-benefit of reducing dependence on oil imports, enhancing energy security and improving resilience to energy price shocks. The global transition to zero-emission vehicles is already avoiding nearly 1.7m barrels of oil per day.⁷

Taking action to decarbonise the transport sector offers the opportunity to reconsider how transport systems are designed and how wider benefits of cleaner air, more liveable cities, and reduced oil dependency can be maximised. Decarbonising the transport sector will clean up the air we breathe: transport tailpipe emissions were responsible for c. 385,000 premature deaths in 2015⁸. Shifting away from technologies that emit pollutants with harmful health impacts will help avoid excess deaths from air pollution, alongside putting us on track to decarbonise the transport sector.

The need to clean up air becomes even more pressing as our populations become more urbanised. 68% of the world's population is expected to live in cities by 2050⁹, planning for low-carbon transport systems offers the opportunity to plan for more liveable cities as the urban population grows. Achieving the transition to greener, cleaner, and more resilient transport systems also means affordable, safe, and inclusive services and improving access for marginalised groups. We recognise that alongside the shift to clean technologies, a sustainable future for transport provides us with the opportunity to reimagine how we design our cities, and achieving these goals will require wider system transformation, including support for active travel, public, and shared transport.

Decarbonising the transport sector in line with the goals of the Paris Agreement is still within reach but requires urgent action. Governments will play a critical role in creating the policies and incentives needed to support the transition to cleaner transportation systems. Progress has been made to raise the profile of the transport sector in international climate and energy discussions, with clear pathways emerging on international actions to support decarbonising this sector. COP26 in Glasgow resulted in an unprecedented number of net-zero pledges, strategic declarations, commitments, and initiatives related to transport, with further programmes on scaling up financing and "avoid and shift" measures announced at COP27. Moving towards COP28, there is a need for concerted action to disrupt the existing transport decarbonisation pathway and put it on track to deliver the goals of the Paris Agreement.

High-Level Principles for Transport Decarbonisation

As the world's largest economies, responsible for 70% of global CO₂ emissions from transportation¹⁰, the G20 are uniquely situated to play a leading role in enabling and delivering the global decarbonisation of the transport sector, shifting global investment towards the clean technologies required to do so. The following high-level principles set out a common, international framework to guide the decarbonisation of the transport sector. These principles provide a shared vision and supporting actions that will not only deliver a decarbonised transport sector but a more sustainable way of life for our populations and future generations.

1. Implement ambitious policies and targets to reduce emissions from transport:

Governments must develop and deliver on clear evidenced-based national transport decarbonisation plans. These require the implementation of ambitious policies across all transport modes that support a transport decarbonisation pathway aligned with domestic net zero targets and the goals of the Paris Agreement. As well as reducing life cycle emissions from transport technologies, policies should encourage a shift from private vehicles to collective, shared, and active modes. As far as possible, governments should align on pathways for the deployment of clean technologies to build market confidence in the trajectory of the transition, securing investment and creating economies of scale for new technologies for motorised transport.

2. Promote a resource-efficient and circular economy for the transport sector:

Financial and resource efficiency of the transport system must be secured to enable long-term decarbonisation of the transport sector. Improving the energy efficiency of transport and promoting circular economy principles is essential to achieve a timely clean energy transition and manage the scale of the required renewable energy infrastructure needed to decarbonise the sector.

3. Ensure equity is at the heart of decarbonising the transport sector: The decarbonisation of the transport sector must be truly global, with no country or community left behind. Governments should work to ensure emerging markets and developing economies can transition to a decarbonised transport system. These systems should be designed with inclusivity in mind, and governments should actively manage the industrial transition for workers. Decarbonising through a technology transition alone will neither fully address health and safety, nor the liveability of cities, nor improve access to opportunities. Public transport, active mobility, and shared and micromobility should be integrated to offer high-quality, affordable transport solutions for all.

4. Ensure resilient transport systems: The transport sector must prepare its systems, supply chains, workforce, infrastructure, and energy supply to build resilience to a changing and destabilised climate, including the capacity to withstand extreme weather events, deal with increased storm surges and rising sea levels, adapt to disrupted ecosystems and human systems while delivering essential services to populations.

5. Collaborate across sectors and actors to facilitate decarbonisation of transport and leverage wider benefits: The transport sector must work hand in hand with related industries such as energy, trade, and tourism to ensure transition plans are aligned and transport and energy needs are met. Governments should forge coalitions with the private sector and explore innovative financing models to support the flow of investment into clean transport projects.

6. Collaborate internationally to facilitate the global decarbonisation of the transport sector: Governments should continue to form and participate in international coalitions to work together to create economies of scale for clean technologies, overcome shared challenges to decarbonising the sector and realise shared benefits of the transition.

Principle 1

Implement ambitious policies and targets to reduce emissions from transport

Governments must develop and deliver on clear evidence-based national transport decarbonisation plans. These require the implementation of ambitious policies across all transport modes that support a transport decarbonisation pathway aligned with domestic net zero targets and the goals of the Paris Agreement. As well as reducing life cycle emissions from transport technologies, policies should encourage a shift from private vehicles to collective, shared, and active modes. As far as possible, governments should align on pathways for the deployment of clean technologies to build market confidence in the trajectory of the transition, securing investment and creating economies of scale for new technologies for motorised transport.

Government policy action is the single biggest measure that will enable the transport sector to decarbonise. In order to achieve net zero targets, it is imperative there is a clear national pathway for reducing emissions from the transport sector to net zero in each market. These plans should set out a decarbonisation roadmap and related actionable policies for each mode of transport. The plans must also encourage transitioning to sustainable transport modes, including public, shared and active transport. Transitioning vehicle fleets to zero-emission technologies alone will not achieve decarbonisation targets within the necessary timelines. Moreover, achieving sustainability and accessibility targets will require modal shifts away from private vehicle use, particularly in the urban context.

The transition to zero-emission light-duty vehicles is already underway and accelerating. Despite supply chain issues, 2021 was a record-breaking year for zero-emission vehicle sales. Zero-emission two- and three-wheelers lead the way, with nearly 40% of new sales being zero-emission in 2021¹¹. For cars and vans, deployment is accelerating but is unevenly distributed across regions¹², signalling the need to support the deployment of zero-emission vehicles in emerging markets to avoid a two-tiered global car market. Given the technological readiness of the light-duty vehicle transition, government action should focus on enabling the mass deployment of these technologies across all regions, collaborating internationally to reduce supply chain bottlenecks.

The transition to zero-emission medium and heavy-duty vehicles is also getting underway. Buses are leading the way, with 13.8% of buses sold in 2021 being zero emission.¹³ Trucks are lagging behind at 0.3%¹⁴, but more zero-emission truck models are coming to market - signalling the beginning of this transition. Government intervention should focus on investments, target setting, the deployment of charging and refuelling infrastructure, and regulations to support the market entry of these products. Where possible, governments should enable mass procurement of zero-emission fleets.

The shipping and aviation sectors are particularly challenging to decarbonise, and zero-emission technologies are still under development. The ICAO and IMO are responsible for regulating emissions from the international aviation and shipping sectors, respectively. ICAO has adopted a long-term global aspirational goal (LTAG) for international aviation of net-zero carbon emissions by 2050 in support of the Paris Agreement's temperature goal. In addition, governments should consider how to reduce emissions from domestic aviation. This year, the Marine Environment Protection Committee under the IMO will adopt a revised greenhouse gas emissions reduction strategy for the shipping sector. To ensure the delivery of these goals, governments should focus on accelerating the development and early-stage deployment of low-carbon fuels and energy-efficient technologies with targeted measures. In parallel, governments need to continue to shape international policy frameworks at the IMO and ICAO to reduce the price gap with conventional fuels.

G20 High-level Principles for Transport Decarbonisation

Setting out clear deployment targets for these zero-emission technologies and fuels will embolden industry to invest in clean technologies and ensure a runway is laid to scale up deployment towards zero emissions. For hard-to-decarbonise sectors, the focus should be on policies that support innovation in and commercialisation of technologies that will enable to decarbonise these modes.

Deployment of charging infrastructure will be a critical driver for the electrification of the transport system, and thus deployment of the requisite charging infrastructure must go hand in hand with the deployment of clean technologies. Governments must work to enable and incentivise the deployment of charging stations and points, including through medium and long-term target setting. Domestic manufacturing capabilities for refuelling infrastructure can be incentivised by the introduction of localisation mandates.

Scaling up the deployment of clean technologies is important, but modal shift is also a significant potential driver of decarbonisation and should also be addressed. Increasing bus and train usage and prioritising clean public transport vehicles offers the best chance at more efficiently meeting transport demand with a lower carbon footprint where these modes are viable.

Governments should develop a strategic approach to ensuring that adequate funding is available to underpin the development of public transport systems, including by adopting efficient fare-setting policies and processes, exploiting land value capture opportunities in and around transit developments and exploring the potential for hypothecated taxes. An efficient tax regime for private cars – particularly ICE vehicles – can provide one important element of such an earmarked tax base.¹⁵

While taking account of different domestic challenges and pathways, as far as practicable, governments should look to align pathways and technologies internationally to create economies of scale and support a faster and more cost-effective transition for all. Additionally, a robust national transport decarbonisation plan can support both the implementation of NDC targets and enable an increase in NDC ambition in the next round of updates in 2025.

Examples of possible policies and actions within plans to reduce emissions from transport:

- 1.1. Targets for the phase-out of polluting technologies. Over recent years an increasing number of countries have come forward with phase-out targets for the sale of new internal combustion engine vehicles. Countries with phase-out targets now account for 19% of the passenger vehicle market. The [Zero Emission Vehicles Declaration](#) and [Global MOU on Zero-Emission Medium and Heavy-Duty Vehicles](#) were both launched at COP26 and bring together coalitions of governments and private sector actors committed to a Paris-aligned transition to zero-emission light, medium, and heavy-duty vehicles.
- 1.2. Measures to support the deployment of charging infrastructure. Jurisdictions worldwide have taken varying policy approaches to expand the EV-charging network, often adopting a combination of policy measures. Some have made direct public-sector investments in installing the charging assets to kick-start the charging network and provide confidence and leadership. Some countries have introduced tax credits or subsidies to stimulate and support the installation of chargers by private entities and individuals or else to establish high-quality commercial charging services. Regulations have also set binding targets and established minimum standards for the installation of EV chargers in new developments or set out EV-readiness requirements to make future installation simpler. For HDVs, a greater emphasis on the roll-out of depot charging will be needed.¹⁶
- 1.3. Targeted support for scaling up the deployment of clean technologies and fuels for aviation and maritime. Carbon pricing can be a mechanism for reducing the price difference

G20 High-level Principles for Transport Decarbonisation

between high and low-carbon fuels for both the aviation and maritime sectors¹⁷. In Norway, the carbon tax rates for inland transport depend on the energy source, with the highest rates for petrol and the lowest rates for heavy mineral oils, such as ship fuels. Since 2018, Norway has applied the standard carbon tax rate also to LNG and liquefied petroleum gas (LPG) for domestic shipping¹⁸.

- 1.4. Fuel efficiency standards are a tool for quantifiably reducing the carbon footprint of the transportation sector. As part of the European Union's Fit for 55 package, the [EU introduced new legislation](#) requiring a reduction of CO₂ emissions from 2021 of 55% for cars and 50% for vans by 2030 and by 100% for both cars and vans by 2035. This sets a clear path towards zero CO₂ emissions for new passenger cars and light commercial vehicles.
- 1.5. Public procurement of zero-emission vehicles for government services: At the Clean Energy Ministerial in 2022, nine countries (including four G20 members) committed to aiming for 100 per cent zero-emission light-duty vehicle acquisitions of their civil government-owned and operated fleet – aspiring towards 100 per cent zero-emission medium- and heavy-duty vehicle acquisitions – by no later than 2035¹⁹. Another example is the French Postal Service, which has implemented policies to jumpstart the French EV market by procuring electric vans (7000 out of 27 000 total and growing) and electric bicycles (18 000 and growing).
- 1.6. Mass procurement of zero-emission fleets: The Government of India announced the procurement of 50000 e-buses through to 2030 to support achieving India's decarbonisation strategy, curb pollution, and improve energy security. This procurement will support the mass roll-out and cost efficiency of e-buses in India and beyond.

Principle 2

Promote a resource-efficient and circular economy for the transport sector

The financial and resource efficiency of the transport system must be secured to enable long-term decarbonisation of the transport sector. Improving the energy efficiency of transport and promoting circular economy principles is essential to achieve a timely clean energy transition and manage the scale of the required renewable energy infrastructure needed to decarbonise the sector.

Moving towards integrated circular economy principles for new vehicle technologies, such as electric vehicles, will be critical to meet broader climate and environmental and social governance ambitions. Life cycle assessments can guide investments in innovation to reduce emissions. Sustainable production of vehicles is vital to support the decarbonisation of the transport fleet, and measures to manage the end-of-life of these products are vital to meet broader climate and environmental ambitions.

To ensure the integrity of this transition, action must be taken to ensure critical materials are produced, sourced, processed, transported, manufactured and recycled in a responsible and sustainable manner which minimises environmental harm, respects human rights, and creates benefits for stakeholders along the supply chain²⁰. Governments can consider the co-benefits of promoting the recycling and reuse of materials at the end of life, for example, the use of electric vehicle batteries for energy storage and the scrapping of ICE vehicles to incentivise the uptake of zero-emission technologies.

Meeting ambitious decarbonisation goals in line with the Paris Agreement will require new technologies to be deployed at a historically unprecedented speed. Promoting an energy-efficient transport system and managing transport demand by promoting shifts to more energy-

G20 High-level Principles for Transport Decarbonisation

efficient modes is essential to help to reduce the required infrastructure needed. Promoting the shift to zero-emission vehicles and improving the fuel efficiency of new vehicles through policy measures, such as fuel economy standards, can be highly effective mechanisms to reduce fuel consumption and improve the cost-effectiveness of transport systems. G20 nations can help to support countries without fuel economy policies to develop effective regulations to measure and benchmark fuel efficiency improvements. Key to this is helping to support capacity building and building off existing international regulations.²¹.

Ensuring the financial and resource sustainability of the transport system is vital to enabling the long-term decarbonisation of the transport sector. Governments should consider actions to promote the reduction of life cycle emissions from the transport fleet across production and end-of-life, energy efficiency, and taxation models that enable this. Capacity building and improving transparency about life-cycle emissions are important actions to embed whole-systems thinking in the transition.

Additionally, as was recognised in the [G20 Pittsburgh Leaders Declaration](#) in 2009, inefficient fossil fuel subsidies encourage wasteful consumption, reduce our energy security, impede investment in clean energy sources and undermine efforts to deal with the threat of climate change. Governments should work to rationalise and, where possible, phase out fossil fuel subsidies. Similarly, due to the shift to electrification, governments will see a reduction in tax revenues from fuel taxes. Governments should look to reform their fuel taxes to ensure the long-term financial sustainability of revenue alongside the decarbonisation of the transport sector.²².

It is imperative that governments work with the private and energy sectors to invest in the enabling infrastructure for these transitions, taking account of the long-term needs of the transport sector as it decarbonises and reducing the need for further substantial infrastructure investment at a later date.

Examples of possible policies and actions that will ensure an efficient and circular economy for the transport sector:

- 2.1. Regulations on battery recycling: the [EU is developing rules](#) for the regulation of batteries in the EU, requiring from 2026 that all batteries have a battery passport, which will track the carbon footprint, percentage of recycled products, and health of batteries. This aims to reduce the social and environmental risks that may occur in the activities of supplying materials, transformation and commercialisation of storage systems.
- 2.2. Vehicle Scrapping Policy to incentivise EV adoption: India's Vehicle Scrappage Policy took effect in April 2022, which aims to phase out old passenger and commercial vehicles and thereby reduce urban air pollution, increase passenger and road safety, and stimulate vehicle sales. The policy requires passenger vehicles older than 20 years and commercial vehicles older than 15 years to pass a "fitness and emissions test" to keep their registration. Vehicles failing the mandatory test are defined as end-of-life vehicles, lose their registration certificate and are recommended to be scrapped. The policy further introduces incentives to scrap old vehicles, including discounts on the purchase of new vehicles against a scrappage certificate.
- 2.3. Reform of fuel taxes: several governments have already put systems in place to move away from fuel tax, adopting forms of distance-based charging. New Zealand and Australia both have schemes based on odometer readings. In the USA, Oregon, Virginia and Utah have adopted schemes that allow users to choose between an annual fee or a per-mile charge, depending on which is cheaper based on their level of usage.¹

¹ ITF Transport Outlook 2023

Principle 3

Ensure equity is at the heart of decarbonising the transport sector

The decarbonisation of the transport sector must be truly global, with no country or community left behind. Governments should work to ensure emerging markets and developing economies can transition to a decarbonised transport system. These systems should be designed with inclusivity in mind, and Governments should actively manage the industrial transition for workers. Decarbonising through technology transition alone will neither fully address health and safety, nor the liveability of cities, nor improve access to opportunities. Public transport, active mobility, and shared and micromobility should be integrated to offer high-quality, affordable transport solutions for all.

While the transition to clean transport technologies has been accelerating, progress is largely concentrated in advanced markets. This risks a two-track transition for clean technologies²³ where emerging markets are unable to benefit from wider benefits an accelerated transition can bring and risk achieving our shared climate ambitions, including keeping 1.5°C within reach²⁴.

There is a significant gap in the funding needed to adequately support the early phase of the zero-emission vehicles transition in emerging economies in the next five years; thus far, only 6.5% of the estimated funding required has been delivered²⁵. Governments should work with multilateral development banks, sovereign wealth funds, and the private sector to mobilise investment for emerging markets and developing economies to ensure they are able to decarbonise their transport sector alongside developed economies. Innovative funding methods should be explored to reduce the risk and substantial costs of initial investments, such as ZEV and battery leasing models, ZEV aggregation models, the inclusion of EZV purchases in sustainability-linked loans, and interest rate subventions.

The dumping of inefficiently used internal combustion engine vehicles not only represents a barrier to the decarbonisation of the transport sector but also has significant health implications resulting from pollutants and reduced safety. Both exporting and importing governments should explore regulations to manage the trade in used vehicles, ensure they are road-worthy, energy efficient, and align with decarbonisation trajectories. Similarly, international trade in second-hand zero-emission vehicles is emerging, and governments should explore actions to ensure this is effectively regulated.

Governments should ensure new urban transport systems are sustainable-by-design and evaluate potential decarbonisation policies in line with the accessibility needs of the population and wider policy objectives. For example, measures that reduce car dependency in cities and improve public transport services will make mobility more affordable and improve access to opportunities for citizens without access to private vehicles.

Reducing congestion and the space used by individual motor traffic helps make cities more livable and safer by reducing the risk of traffic crashes and healthier by cutting down harmful air pollutants caused by road traffic²⁶. Urban mobility should be managed on a multi-modal basis. Integrated solutions are required, based on the effective integration of public transport and other sustainable modes, including shared and active transport and micromobility. It also requires governments to take a leading role in facilitating and potentially providing mobility as a service that can reduce the time and money costs of multi-modality and increase its attractiveness.

Governments should work to assess the impact on different groups of decarbonising the transport sector and take steps to actively manage the transition to ensure both workers and vulnerable groups are protected. The transition of the transport sector to clean technologies will have labour impacts for those who work both in the transport and energy sectors, through both

G20 High-level Principles for Transport Decarbonisation

creating jobs in new industries and offering new economic opportunities from decentralised production of renewable energy.

Additionally, as clean technologies are deployed, governments should take steps to ensure equal access to these technologies by considering equity in the deployment of enabling infrastructure and the affordability for the population of both incumbent and new technologies through fuel and energy price fluctuations. A fundamental step is to reform tax and incentive systems to ensure the most cost-effective incentive structures to encourage moves towards sustainable modes are reliably identified and implemented.

Examples of actions and policies to achieve an equitable global transition to a decarbonised transport sector:

- 3.1. Financing for emerging markets: [The Collective for Clean Transport Finance](#), under development and announced at COP27, is working to bring together sustainability organisations to aggregate and design projects that will help institutional investors and sovereign wealth funds to increase and accelerate investments into sustainable transport²⁷.
- 3.2. The EU's sustainable and smart mobility strategy sets out an approach to making mobility fair and just for all, including exploring all possibilities under the just transition mechanism to make new mobility ensuring affordable and accessible in all regions and for all passengers²⁸.
- 3.3. Programmes to provide access to clean shared mobility: California has introduced two pilot grant programmes, which are designed to develop community-scale clean mobility programmes in priority communities. Clean Mobility Options provides grant funding to pilot innovative shared and on-demand clean transportation projects in California's historically underserved communities. The Sustainable Transportation Equity Project provides grants to assess transportation needs, build community support, and prepare for implementing clean transportation projects, including zero-emission buses, new vanpool services, and bike and pedestrian paths²⁹.
- 3.4. Trade in used vehicles: The 15 Economic Commission of West African States ECOWAS has imposed a rule to import only Euro 4 vehicles and an age limit of five years for imported light-duty vehicles (LDV) and ten years for heavy-duty vehicles (HDV). Egypt and Bhutan ban the import of other used vehicles but allow the import of used electric vehicles³⁰.
- 3.5. Supporting a just transition for workers: In 2021, the French Government unveiled a EUR 50 million (USD 60.5 million) fund to retrain workers making cast-metal auto parts whose jobs are at risk as the industry shifts to electric vehicles. The fund includes contributions from Stellantis and Renault in addition to the French government.

Principle 4

Ensure resilient transport systems

The transport sector must prepare its systems, supply chains, infrastructure, workforce and energy supply to build resilience to a changing and destabilised climate, including the capacity to withstand extreme weather events, deal with increased storm surges and rising sea levels, adapt to disrupted ecosystem and human systems while delivering essential services to populations.

In line with the work of the G20 Disaster Risk Reduction working group, governments should work to increase their commitments towards making infrastructure systems disaster and climate-resilient.

G20 High-level Principles for Transport Decarbonisation

It is imperative that our built infrastructure and networks are future-proofed so that they can still deliver connectivity despite the disruptive effects of climate change. Transport infrastructure represents a significant sunken public and private investment that is fundamental to the functioning of society³¹. Transport is one of several critical networks which, combined, deliver essential services. All networks (road transport, rail transport, public transport, airports, ports – but also power, water and communications networks) are interconnected and often co-located.

Policy should recognise these linkages, applying an ecosystems-based approach to disaster risk reduction and focusing on delivering continuity of service across multiple, interlinked networks. Network assets are often long-lived and, if regularly maintained, are designed to deliver specified and predictable services over their entire lifetime. Hazards that have historically degraded asset performance or interrupted network services are generally well-known and are accounted for in transport infrastructure, network planning and design. Climate destabilisation significantly erodes that predictability. Investing now in the protection of these assets will ensure cost-effectiveness in the long term.

How infrastructure and networks adapt to disasters is a major adaptation challenge, but an even more critical challenge is how transport adapts to climate-triggered ecosystem transitions and disrupted human systems³² – especially, but not only, in coastal areas. These changes will bring fundamental changes to human settlements and economic activity that will condition both the presence and scope of transport infrastructures and services.

To develop resilient transport systems, governments should act now to preserve the value of transport infrastructure and maintain network performance³³. For assets whose design life or effective period of use extends to 50-plus years, the potential exposure to climate hazards is significant. For less long-lived assets, climate impacts must be anticipated when renewing infrastructure.

Governments must prepare for more frequent and unexpected failures of transport infrastructure and assess the vulnerability of transport assets and networks to climate change and extreme weather. Additionally, governments should focus on preserving overall service continuity for the transport networks, not just on designing robust infrastructure. Additionally, governments must prepare to accompany, and in some cases lead, the potential relocation of settlements and activities in response to the consequences of long-term climate destabilisation.

Resilience-based approaches accept asset failure as an unwanted but occasionally unavoidable consequence of climate change, working to minimise the consequences of an asset becoming unavailable. In addition to ensuring our transport systems are resilient, governments should consider how they can move towards regenerative transport systems, through which systems are evolved following each shock to better serve the needs of populations.

We can improve our resilience to energy crises by transitioning away from fossil fuels and to more efficient zero-emission transport technologies. With more efficient vehicles, energy costs are a much smaller share of total costs, which means energy price jumps are far less impactful. In addition to ensuring the resilience of transportation infrastructure, governments should work to secure a resilient supply of energy for use in the transport sector. Governments should align ambitious targets for transport technologies, such as electric vehicles, with the required ambitions for renewable energy deployment. Conversely, ensuring energy efficiency of the transport sector will cushion the impact of disruptions in energy supply and cost.

Examples of key actions that deliver a disaster-resilient transport sector include but are not limited to, the following:

4.1. Operationalise the key components of the Sendai Framework for Disaster Risk Reduction in national and sub-national policies. In 2015, 187 nations adopted the Sendai Framework for

G20 High-level Principles for Transport Decarbonisation

Disaster Risk Reduction (SFDRR 2015-2030). Operationalising the SFDRR entails advancing five strategic actions, all of which are relevant to transport. These actions are:

- *Global coverage of Early Warning Systems for all hydro-meteorological disasters:* Failures in interlinked transport networks can have important human and economic consequences. Contribution, and access, to early warning systems can help trigger preventative actions (like bridge or road closures) and minimise disruptions.
- *Increased commitment towards making infrastructure systems disaster and climate resilient:* Adopting a pro-resilience approach to infrastructure construction and maintenance and service continuity can reduce losses from climate and other disasters.
- *Stronger national financial frameworks for disaster risk reduction:* Improved resilience must be factored into infrastructure construction and maintenance costs and financing as well as in pro-resilience planning.
- *Strengthened national and global disaster response system to address the consequences of increasing frequency and intensity of disasters:* The impact of disrupted network connectivity and infrastructure failure can extend quickly beyond the point(s) of failure and into other economic spheres. International and inter-regional co-ordination and planning can help minimise and contain impacts.
- *Increased application of ecosystems-based approaches to disaster risk reduction:* The very environment in which infrastructure and networks are embedded is likely to change, and this may erode their resilience to disasters. At the same time, there is considerable scope to leverage ecosystem services to protect networks or minimise the consequences of disasters – for example, by encouraging the natural absorption of extreme precipitation by protected wetlands. These approaches should be integrated into infrastructure and network planning, design and deployment.

- 4.2. Integrating disaster risk into the life-cycle management of transport infrastructure: Following on the second SFDRR-supportive action outlined above, strategies to integrate disaster risk-based approaches into life-cycle infrastructure management are essential. In South Asia, the World Bank piloted the integration of disaster risk into the life-cycle management of transport infrastructure. A transport asset management system was developed in Bhutan that incorporated appropriate vulnerability attributes. The database helps monitor assets to plan operations and maintenance activities but also helps identify critical and weak links in the transport network that are vulnerable to disasters. Additional pilots of the approach are being prepared in Sri Lanka, Nepal, and Belize. The objective of these engagements is to raise awareness beyond the ministries of transport, particularly with ministries of finance, on the importance of understanding current risks, reducing transport infrastructure vulnerability, and ensuring future risks are fully taken into account in new transport infrastructure investments and plans³⁴.
- 4.3. Establish a national critical infrastructure climate change and extreme weather adaptation plan: Plans should incorporate risk assessments that account for extreme uncertainty, outline incident management guidelines and longer-term network management, maintenance and investment strategies that ensure continuity of service despite likely climate disruption. Examples of such plans include the EU Strategy on Adaptation to Climate Change, the German Strategy for Adaptation to Climate Change, the French National Plan for Adaptation to Climate Change and the Dutch National Climate Adaptation Strategy 2016 (NAS).
- 4.4. Develop adaptation risk assessment exercises, protocols and methodologies, incentivising the use of these in national and sub-national infrastructure planning and investment. Examples include the Canadian Public Infrastructure Engineering Vulnerability Committee (PIEVC) Engineering Protocol, the European Climate Risk Assessment (EUCRA), the US

National Cooperative Highway Research Program (NCHRP) Incorporating the Costs and Benefits of Adaptation Measures in Preparation for Extreme Weather Events and Climate Change—Guidebook and the UK National Infrastructure Commission's 'Anticipate, React, Recover: Resilient Infrastructure Systems'. Some national climate change assessments may be piloted by stakeholder groups alongside public authorities, as in the Federation of Indian Chambers of Commerce and Industry report 'Accelerate Action on Adaptation in the Transport Sector'.

- 4.5. Consult citizens to identify threats and find solutions: Guadalajara in Mexico will most likely suffer from even higher temperatures and more extreme weather events. Through workshops, citizens demanded investing in planting further trees in the city. Trees provide shade, help regulate water flows and prevent floods through increased permeability. At the same time, they bring mitigation co-benefits by binding CO₂³⁵.

Principle 5

Collaborate across sectors and actors to facilitate the decarbonisation of transport and leverage wider benefits

The transport sector must work hand in hand with related industries such as energy, trade, and tourism to ensure transition plans are aligned and transport and energy needs are met. Governments should forge coalitions with the private sector and explore innovative financing models to support the flow of investment into clean transport projects.

The transport sector is intrinsically linked to other key sectors of the global economy. Decarbonising the transport sector will have a significant impact on global energy demand and supply chains. It is imperative that coalitions are forged between the energy and transport sectors to assess and prepare the energy sector for the changing needs of the transport sector through decarbonisation – ensuring grid readiness for electrification and supporting the scale-up and innovation in zero-emission fuels, including green hydrogen and sustainable aviation fuels for maritime and shipping. Similarly, fossil fuels represent 36.6% of global freight transport.³⁶, as demand for fossil fuels decreases, the freight industry needs to be prepared for this reduction in demand.

The support and actions of the private sector are core to delivering a decarbonised transport system, especially to unlock investment in decarbonising the transport sector. Governments should work with the private sector to explore financing tools to achieve this, such as hedging mechanisms, blended finance, and first-loss guarantees. Governments should also work to stimulate innovation through alliancing and early contractor involvement to ensure businesses have the best regulatory environment to deploy clean technologies and that industrial transition and technology deployment plans align.

Forging multi-actor coalitions through a collaborative process can support the accelerated deployment of finance into clean transport projects. Firstly, through leveraging public sector ambition to send a strong market signal for the creation of deal flow and de-risking investment through regulation, policy, contracts, and structures. Demand aggregation can then build a pipeline of projects. Finally, finance blending mechanisms can be deployed to address residual risk ahead of syndicating investors, industry, and financial institutions around a flow of bankable projects.³⁷

By sharing knowledge and best practices, governments can learn from each other and develop more effective and efficient strategies for reducing emissions in the transport sector. Collaboration can also drive innovation and accelerate the development and deployment of low and zero-carbon transport technologies, such as electric vehicles, hydrogen fuel cells, and sustainable aviation fuels. By working together, countries can leverage resources and funding to support research and development, pilot projects, and infrastructure investments. Additionally,

G20 High-level Principles for Transport Decarbonisation

national governments should work with cities, states and regions to consider how national government action and frameworks can enable and leverage action at the subnational level.

Three-quarters of CO₂ emissions from tourism are transport-related³⁸. Emissions from transporting tourists have grown steadily over the past decades, reaching almost 1,600 million tonnes of CO₂ in 2016, amounting to 5% of all energy-related CO₂ emissions. The number of tourists travelling across borders is expected to reach 1.8 billion a year by 2030. This will be alongside a further 15.6 billion domestic tourist arrivals.

Such growth will bring many opportunities, including socio-economic development and job creation, but will have consequences for the greenhouse gas emissions linked to tourism-related transport, challenging the tourism sector's ambition to meet the targets of the Paris Agreement. Consequently, it is imperative that the transport and tourism industry work together to determine clear decarbonisation pathways that account for increased transport demand from tourism.

Examples of existing fora to support cross-sectoral multi-actor co-operation:

- 5.1. The [Clean Energy Ministerial \(CEM\)](#) is a high-level global forum to promote policies and programmes that advance clean energy technology, share lessons learned and best practices, and encourage the transition to a global clean energy economy. Several CEM campaigns and initiatives support the deployment of clean energy technologies in the transport sector, including electric vehicles and hydrogen.
- 5.2. [First Movers Coalition](#) is a global initiative harnessing the purchasing power of companies to decarbonise seven "hard to abate" industrial sectors, including aviation, shipping, and trucking, sending a powerful market signal to commercialise zero-carbon technologies.
- 5.3. Free Trade Agreements and/or mining agreements could be an effective tool to support sustainable procurement of critical materials. Nations with large reserves of the critical minerals required for zero carbon transport technologies could look to pursue such agreements, focusing on long-term procurement of minerals required for both clean transport and clean energy technologies like electrolysers and solar panels. These agreements can support stakeholders in developing long-term offtake and co-development contracts.

Principle 6

Collaborate internationally to facilitate the global decarbonisation of the transport sector

Governments should continue to form and participate in international coalitions to work together to create economies of scale for clean technologies, overcome shared challenges to decarbonising the sector and realise shared benefits of the transition.

International collaboration can support accelerated decarbonisation of transport supports through knowledge sharing and joint working to overcome shared challenges. International collaboration can support mass procurement, providing the private sector with the confidence to invest in the development of clean technologies.

Aligning procurement standards across borders can additionally help unlock mass procurement opportunities. Governments aligning on a pathway to transition to new technologies can also bring forward the cost parity tipping point, making the transition quicker and cheaper for all.³⁹

Evidence and data-driven policy decisions are vital to getting this transition right, with life cycle assessments forming a vital data point to support decision-making. International collaboration can also focus on the sharing of data, including through knowledge-sharing platforms.

G20 High-level Principles for Transport Decarbonisation

Examples of existing fora to support international co-operation:

- 6.1. The Road Transport Breakthrough under the [Breakthrough Agenda](#) was launched by 30 world leaders at COP26 and is a commitment to work together this decade to make zero-emission vehicles the new normal by 2030. At COP27, governments endorsed eight priority international actions to achieve this goal, including on aligning transitional targets, scaling up financing for emerging markets and developing economies, creating a global vision for infrastructure deployment, and regulating trade in second-hand vehicles.
- 6.2. [ZEV Transition Council](#) (ZEVTC) brings together governments representing the biggest and most progressive auto markets to collaborate on how to accelerate the global ZEV transition. Under the ZEVTC, the [ZEV Emerging Markets Initiative](#) was launched at COP27 to help both countries and companies achieve their ambitious ZEV deployment goals by fostering communication of potential private-sector investment targets and private-sector advocacy for planned policy measures that will enable their achievement.
- 6.3. The [International Transport Forum](#) (ITF) provides a platform for governments to come together to overcome shared challenges and implement policies to decarbonise transport, underpinned by expert research. The ITF's "[Transport Decarbonisation: Driving Implementation](#)" project brings countries together to identify ways to cut CO₂ emissions in hard-to-decarbonise areas of transport: aviation, shipping and heavy-duty road freight.

+++

This background note was drafted by the secretariat of the International Transport Forum drawing on ITF research outputs. This note does not reflect the policy or positions of ITF member countries. This note was drafted at the request of India (an ITF member) to support discussions on transport decarbonisation under the G20.

Notes

-
- ¹ ITF Transport Outlook 2023
- ² https://stats.oecd.org/BrandedView.aspx?oeed_by_id=co2-data-en&doi=data-00429-en#
- ³ 2019 emissions from the transport sector fuel combustion for each G20 member in Mt CO₂. Argentina 47.62; Australia 104.16; Brazil 193.96; Canada 184.53; China 1,052.80; European Union 828.81; France 126.06; Germany 164.79; India 325.38; Indonesia 149.67; Italy 104.10; Japan 209.63; Mexico 150.68; South Korea 107.94; Saudi Arabia 136.68; South Africa 56.93; Türkiye 84.32; United Kingdom 209.63; United States 1,763.18;
- ⁴ ITF Transport Outlook 2023
- ⁵ Ibid.
- ⁶ IEA 2021
- ⁷ Bloomberg NEF 2022 COP27 Zero Emission Vehicles Factbook
https://assets.bbhub.io/professional/sites/24/2022-COP27-ZEV-Transition_Factbook.pdf
- ⁸ ICCT 2019 Health Impacts of Transport Emissions <https://theicct.org/new-study-quantifies-the-global-health-impacts-of-vehicle-exhaust/>
- ⁹ United Nations, Department of Economic and Social Affairs, Population Division, 2019
- ¹⁰ Excluding international aviation and shipping, which are not allocated to specific countries.
- ¹¹ BloombergNEF 2022 COP27 Zero Emission Vehicles Factbook
https://assets.bbhub.io/professional/sites/24/2022-COP27-ZEV-Transition_Factbook.pdf
- ¹² Ibid.
- ¹³ IEA, IRENA, & UN Climate Change High-Level Champions, [Breakthrough Agenda Report 2022](#).
- ¹⁴ Ibid.
- ¹⁵ [ITF Funding Public Transport Working Group](#) (report forthcoming)
- ¹⁶ ITF Transport Outlook 2023
- ¹⁷ ITF Transport Outlook 2023
- ¹⁸ ITF 2022 [Carbon Pricing in Shipping \(www.itf-oecd.org\)](http://www.itf-oecd.org)
- ¹⁹ <https://www.cleanenergyministerial.org/initiatives-campaigns/electric-vehicles-initiative/>
- ²⁰ Global Battery Alliance: <https://www.globalbattery.org/>
- ²¹ ITF 2022, [Implementing the ASEAN Fuel Economy Roadmap](#)
- ²² ITF 2023, Decarbonisation and the Pricing of Road Transport
- ²³ BloombergNEF
- ²⁴ <https://zevtc.org/global-commitment/>
- ²⁵ <https://theicct.org/wp-content/uploads/2022/02/ZEV-EMDE-white-paper-A4-v3.pdf>
- ²⁶ ITF Transport Outlook 2023
- ²⁷ WBSCD <https://www.wbcsd.org/Pathways/Transport-Mobility/News/Strategic-collaboration-to-scale-investments-in-zero-emission-transport>
- ²⁸ [2021-mobility-strategy-and-action-plan.pdf \(europa.eu\)](#)
- ²⁹ <https://innovation.luskin.ucla.edu/wp-content/uploads/2021/04/An-Agenda-for-Equity-Centered-Clean-Transportation.pdf>
- ³⁰ IEA, IRENA, & UN Climate Change High-Level Champions, [Breakthrough Agenda Report 2022](#).
- ³¹ ITF 2016 [Adapting Transport to Climate and Severe Weather](#)
- ³² https://www.ipcc.ch/report/ar6/wg2/downloads/report/IPCC_AR6_WGII_SummaryForPolicymakers.pdf and https://report.ipcc.ch/ar6/wg2/IPCC_AR6_WGII_FullReport.pdf
- ³³ ITF 2016 [Adapting Transport to Climate and Severe Weather](#)
- ³⁴ [WorldBankPublicationResilientTransport.pdf](#)
- ³⁵ [SUTP Sourcebook5f-2_AdaptingTransport-to-ClimateChange.pdf \(transformative-mobility.org\)](#)
- ³⁶ ITF Transport Outlook 2023
- ³⁷ Collective for Clean Transport Finance, tri-lateral collaborative process
- ³⁸ <https://www.e-unwto.org/doi/book/10.18111/9789284416660>
- ³⁹ https://www.exeter.ac.uk/media/universityofexeter/globalsystemsintstitute/documents/Lam_et_al_Evidence_for_a_global_EV_TP.pdf