Non Paper on Transport from IPCC Reports UNFCCC NDC Synthesis Reports

Lifted verbatim from IPCC AR6 WGIII Chapter 10 Transport [AR6 WGIII Chapter10][1], AR6 Synthesis Report Summary for Policymakers [AR6 SYR SPM][2], AR6 Synthesis Longer Report [AR6 SYR Longer Report][3]

1. Emissions from transport

In 2019, direct greenhouse gas (GHG) emissions from the transport sector were 8.7 GtCO2-eq (up from 5.0 GtCO2-eq in 1990) and accounted for 23% of global energy-related CO2 emissions. 70% of direct transport emissions came from road vehicles, while 1%, 11%, and 12% came from rail, shipping, and aviation, respectively. [AR6 WGIII Chapter10]

2. Mitigation options for the transport sector

➢ Cross-cutting sub-topics of second Global Dialogue

- Meeting climate mitigation goals would require transformative changes in the transport sector. **Since the IPCC's Fifth Assessment Report (AR5) there has been a growing awareness of the need for demand management solutions combined with new technologies, such as the rapidly growing use of electromobility for land transport and the emerging options in advanced biofuels and hydrogen-based fuels for shipping and aviation.** There is a growing need for systemic infrastructure changes that enable behavioural modifications and reductions in demand for transport services that can in turn reduce energy demand. The response to the COVID-19 pandemic has also shown that behavioural interventions can reduce transport-related GHG emissions. For example, COVID-19-based lockdowns have confirmed the transformative value of telecommuting replacing significant numbers of work and personal journeys as well as promoting local active transport. There are growing opportunities to implement strategies that drive behavioural change and support the adoption of new transport technology options. [AR6 WGIII Chapter10]

- **There is a growing awareness of the need to plan for the significant expansion of low-carbon energy infrastructure, including low-carbon power generation and hydrogen production, to support emissions reductions in the transport sector *(high confidence).*** Integrated energy planning and operations that take into account energy demand and system constraints across all sectors (transport, buildings, and industry) offer the opportunity to leverage sectoral synergies and avoid inefficient allocation of energy resources. Integrated planning of transport and power infrastructure would be particularly useful in developing countries where 'greenfield' development doesn't suffer from constraints imposed by legacy systems. [AR6 WGIII Chapter10]

- C.3.3 Reducing industry GHG emissions entails coordinated action throughout value chains to promote all mitigation options, including demand management, energy and materials efficiency, circular material flows, as well as abatement technologies and transformational changes in production processes (high confidence). **In transport, sustainable biofuels, low-emissions**

[1] https://www.ipcc.ch/report/ar6/wg3/downloads/report/IPCC_AR6_WGIII_Chapter10.pdf
[2] https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_SPM.pdf
[3] https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_LongerReport.pdf

hydrogen, and derivatives (including ammonia and synthetic fuels) can support mitigation of CO2 emissions from shipping, aviation, and heavy-duty land transport but require production process improvements and cost reductions (medium confidence). Sustainable biofuels can offer additional mitigation benefits in land-based transport in the short and medium term (medium confidence). Electric vehicles powered by low-GHG emissions electricity have large potential to reduce land-based transport GHG emissions, on a life cycle basis (high confidence). Advances in battery technologies could facilitate the electrification of heavy-duty trucks and compliment conventional electric rail systems (medium confidence). The environmental footprint of battery production and growing concerns about critical minerals can be addressed by material and supply diversification strategies, energy and material efficiency improvements, and circular material flows (medium confidence). {4.5.2, 4.5.3} (Figure SPM.7) [AR6 SYR SPM]

- 3.3.3 Reductions in GHG emissions in industry, **transpor**t, buildings, and urban areas can be achieved through a combination of energy efficiency and conservation and a transition to low-GHG technologies and energy carriers (see also 4.5, Figure 4.4). Socio-cultural options and behavioural change can reduce global GHG emissions of end-use sectors, **with most of the potential in developed countries,** if combined with improved infrastructure design and access. (high confidence) [AR6 SYR Longer Report]

- 4.4 … Technology development, transfer, capacity building and financing can support developing countries/ regions leapfrogging or transitioning to low-emissions transport systems thereby providing multiple co-benefits (high confidence) [AR6 SYR Longer Report]

- "The adoption of low-emission technologies lags in most developing countries, particularly least developed ones, due in part to weaker enabling conditions, including limited finance, technology development and transfer, and capacity building." (medium confidence) [AR6 SYR Longer Report]

- Demand per capita in developing and emerging economies is far lower than in Organisation for Economic Co-operation and Development (OECD) countries but is expected to increase at a much faster rate in the next decades due to rising incomes and development of infrastructure. [AR6 WGIII Chapter10]

➢ <u>Collective and non-motorized modes of transport (rail, urban public transit, cycling)</u>

- 4.5.3 Transport-related GHG emissions can be reduced by demand-side options and low-GHG emissions technologies. Changes in urban form, reallocation of street space for cycling and walking, digitalisation (e.g., teleworking) and programs that encourage changes in consumer behaviour (e.g. transport, pricing) can reduce demand for transport services and support the shift to more energy efficient transport modes (high confidence) [AR6 SYR Longer Report]

- **Changes in urban form, behaviour programmes, the circular economy, the shared economy, and digitalisation trends can support systemic changes that lead to reductions in demand for transport services or expand the use of more efficient transport modes *(high confidence)*.** Cities can reduce their transport-related fuel consumption by around 25% through combinations of more compact land use and the provision of less car-dependent transport infrastructure. Appropriate infrastructure, including protected pedestrian and bike pathways, can also support much greater localised active travel. Transport demand management incentives are expected to be necessary to support these systemic changes (high confidence). [AR6 WGIII Chapter10]

- **Legislated climate strategies are emerging at all levels of government and, together with pledges for personal choices, could spur the deployment of demand- and supplyside transport mitigation strategies *(medium confidence).*** At the local level, legislation can support local transport plans that include commitments or pledges from local institutions to encourage behaviour change by adopting an organisational culture that motivates sustainable behaviour, with inputs from the creative arts. Such institution-led mechanisms could include bike-to-work campaigns, free transport passes, parking charges, or eliminating car benefits. Community-based solutions like solar sharing, community charging, and mobility as a service can generate new opportunities to facilitate low-carbon transport futures. At the regional and national levels, legislation can include vehicle and fuel efficiency standards, R&D support, and large-scale investments in low-carbon transport infrastructure. [AR6 WGIII Chapter10]

➢ <u>Energy and resource efficiency sector (design improvements, circular economy and material changes, vehicle vintage, carpooling)</u>

- There is mixed evidence of the effect of circular economy initiatives, shared economy initiatives, and digitalisation on demand for transport services. For example, while dematerialisation can reduce the amount of material that needs to be transported to manufacturing facilities, an increase in online shopping with priority delivery can increase demand for freight transport. Similarly, while teleworking could reduce travel demand, increased ridesharing could increase vehicle-km travelled. [AR6 WGIII Chapter10]

➢ <u>Electrification of vehicles (infrastructure, batteries and minerals)</u>

- "Costs of electrified vehicles are decreasing and their adoption is accelerating, but they require continued investments in supporting infrastructure to increase scale of deployment (high confidence)." [AR6 SYR Longer Report]

- **Battery electric vehicles (BEVs) have lower lifecycle greenhouse gas emissions than internal combustion engine vehicles (ICEVs) when BEVs are charged with low-carbon electricity *(high confidence)*.** Electromobility is being rapidly implemented in micromobility (e-autorickshaws, e-scooters, e-bikes), in transit systems, especially buses, and, to a lesser degree, in the electrification of personal vehicles. BEVs could also have the added benefit of supporting grid operations. The commercial availability of mature lithium-ion batteries (LIBs) has underpinned this growth in electromobility. As global battery production increases, unit costs are declining. Further efforts to reduce the GHG footprint of battery production, however, are essential for maximising the mitigation potential of BEVs. The continued growth of electromobility for land transport would require investments in electric charging and related grid infrastructure (high confidence). Electromobility powered by low-carbon electricity has the potential to rapidly reduce transport GHG and can be applied with multiple co-benefits in the developing world's growing cities (high confidence). [AR6 WGIII Chapter10]

- **There are growing concerns about resource availability, labour rights, non-climate environmental impacts, and costs of critical minerals needed for Lithium-Ion Batteries *(medium confidence).*** Emerging national strategies on critical minerals and the requirements from major vehicle manufacturers are leading to new, more geographically diverse mines. The standardisation of battery modules and packaging within and across vehicle platforms, as well as increased focus on design for recyclability, are important. Given the high degree of potential recyclability of Lithium-Ion Batteries, a nearly closed-loop system in the future could mitigate concerns about critical mineral issues (medium confidence). [AR6 WGIII Chapter10]

- Shifting to low- or zero-carbon fuels (hydrogen, biofuels, biogas, compressed natural gas)

  - "Sustainable biofuels can offer additional mitigation benefits in land-based transport in the short and medium term (medium confidence). Sustainable biofuels, low-emissions hydrogen, and derivatives (including synthetic fuels) can support mitigation of CO2 emissions from shipping, aviation, and heavy-duty land transport but require production process improvements and cost reductions" (medium confidence). [AR6 SYR Longer Report]

  - **Land-based, long-range, heavy-duty trucks can be decarbonised through battery electric haulage (including the use of electric road systems), complemented by hydrogen- and biofuelbased fuels in some contexts *(medium confidence)*.** These same technologies and expanded use of available electric rail systems can support rail decarbonisation (medium confidence). Initial deployments of battery electric, hydrogen- and bio-based haulage are underway, and commercial operations of some of these technologies are considered feasible by 2030 (medium confidence). These technologies nevertheless face challenges regarding driving range, capital and operating costs, and infrastructure availability. In particular, fuel cell durability, high energy consumption, and costs continue to challenge the commercialisation of hydrogen-based fuel cell vehicles. Increased capacity for low-carbon hydrogen production would also be essential for hydrogen-based fuels to serve as an emissions reduction strategy (high confidence). [AR6 WGIII Chapter10][4]

[4] This paragraph is also related to sub-topic electrification of vehicles.

3. Transport in NDCs

Extract findings from the UNFCCC NDC Synthesis Report (2022)[5]

- 83% of Parties referred to mitigation options on transport in NDCs. Most frequently mentioned option was Energy efficiency improvement (52%), followed by cross-cutting (44%) such as low-carbon transport master planning, Electrification (41%), Shift to more efficient modes of transport (39%)" including public transport, Shift to low- or zero-carbon fuels (35%).

  Extract from figure 13 Share of Parties referring to the specific priority areas and frequently indicated mitigation options in national determined contributions

	Share of Parties
Transport	83%
Energy efficiency improvement	52%
Cross-cutting	44%
Electrification	41%
Shift to more efficient modes of transport	39%
Shift to low- or zero-carbon fuels	35%

- For the mitigation options with high mitigation potential costing USD 20/t CO_2 eq or less as identified in IPCC AR6 WGIII report, Fuel-efficient light-duty vehicles (42%) and Fuel-efficient heavy-duty vehicles (40%) were most frequently mentioned in NDCs followed by Shift to public transportation (30%), Biofuels (17%), Shit to bikes and e-bikes (15%), Shipping efficiency and optimization (6%) and Aviation energy efficiency (3%)".

  Extract from figure 14 Share of Parties referring to mitigation options with high mitigation potential costing below USD 20/t CO2 eq in 2030 in nationally determined contributions

	Share of Parties
Fuel-efficient light-duty vehicles	42%
Fuel-efficient heavy-duty vehicles	40%
Shift to public transportation	30%
Biofuels	17%
Shift to bikes and e-bikes	15%
Shipping - efficiency and optimization	6%
Aviation - energy efficiency	3%

[5] https://unfccc.int/sites/default/files/resource/cma2022_04.pdf