Final Draft Summary for Policymakers IPCC WGIII AR5

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SPM.4.2.3 Energy end-use sectors: Transport page 24-25

The transport sector accounted for 27% of final energy use and 6.7 GtCO$_2$ direct emissions in 2010, with baseline CO$_2$ emissions projected to approximately double by 2050 (medium evidence, medium agreement). This growth in CO$_2$ emissions from increasing global passenger and freight activity could partly offset future mitigation measures that include fuel carbon and energy intensity improvements, infrastructure development, behavioural change and comprehensive policy implementation (high confidence). Overall, reductions in total transport CO$_2$ emissions of 15–40% compared to baseline growth could be achieved in 2050 (medium evidence, medium agreement). [Figure TS.15, 6.8, 8.1, 8.2, 8.9, 8.10]

Technical and behavioural mitigation measures for all transport modes, plus new infrastructure and urban redevelopment investments, could reduce final energy demand in 2050 by around 40% below the baseline, with the mitigation potential assessed to be higher than reported in the AR4 (robust evidence, medium agreement**)**. Projected energy efficiency and vehicle performance improvements range from 30–50% in 2030 relative to 2010 depending on transport mode and vehicle type (medium evidence, medium agreement). Integrated urban planning, transit-oriented development, more compact urban form that supports cycling and walking, can all lead to modal shifts as can, in the longer term, urban redevelopment and investments in new infrastructure such as high-speed rail systems that reduce short-haul air travel demand (medium evidence, medium agreement). Such mitigation measures are challenging, have uncertain outcomes, and could reduce transport GHG emissions by 20–50% in 2050 compared to baseline (limited evidence, low agreement). [8.2, 8.3, 8.4, 8.5, 8.6, 8.7, 8.8, 8.9, 12.4, 12.5, Figure SPM.8 top panel]

Strategies to reduce the carbon intensities of fuel and the rate of reducing carbon intensity are constrained by challenges associated with energy storage and the relatively low energy density of low-carbon transport fuels (medium confidence**)**. Integrated and sectoral studies broadly agree that opportunities for switching to low-carbon fuels exist in the near term and will grow over time. Methane-based fuels are already increasing their share for road vehicles and waterborne craft. Electricity produced from low-carbon sources has near-term potential for electric rail and short- to medium-term potential as electric buses, light duty and 2-wheel road vehicles are deployed. Hydrogen fuels from low-carbon sources constitute longer term options. Commercially available liquid and gaseous biofuels already provide co-benefits together with mitigation options that can be increased by technology advances. Reducing transport emissions of particulate matter (including black carbon), tropospheric ozone and aerosol precursors (including NO$_x$) can have human health and mitigation co-benefits in the short term (medium evidence, medium agreement). [8.2, 8.3, 11.13, Figure TS.20, right panel]

The cost-effectiveness of different carbon reduction measures in the transport sector varies significantly with vehicle type and transport mode (high confidence**)**. The levelized costs of conserved carbon can be very low or negative for many short-term behavioural measures and efficiency improvements for light- and heavy-duty road vehicles and waterborne craft. In 2030, for some electric vehicles, aircraft and possibly high-speed rail, levelized costs could be more than USD100/tCO$_2$ avoided (limited evidence, medium agreement). [8.6, 8.8, 8.9, Figures TS.21, TS.22]

Regional differences influence the choice of transport mitigation options (high confidence). Institutional, legal, financial and cultural barriers constrain low-carbon technology uptake and behavioural change. Established infrastructure may limit the options for modal shift and lead to a greater reliance on advanced vehicle technologies; a slowing of growth in light duty vehicle demand is already evident in some OECD countries. For all economies, especially those with high rates of

urban growth, investment in public transport systems and low-carbon infrastructure can avoid lock-in to carbon-intensive modes. Prioritizing infrastructure for pedestrians and integrating nonmotorized and transit services can create economic and social co-benefits in all regions (medium evidence, medium agreement). [8.4, 8.8, 8.9, 14.3, Table 8.3]

Mitigation strategies, when associated with non-climate policies at all government levels, can help decouple transport GHG emissions from economic growth in all regions (medium confidence**)**. These strategies can help reduce travel demand, incentivise freight businesses to reduce the carbon intensity of their logistical systems and induce modal shifts, as well as provide co-benefits including improved access and mobility, better health and safety, greater energy security, and cost and time savings (medium evidence, high agreement). [8.7, 8.10]