

A Global Mission LiFE: Mitigation Potential of Behavioural Change in Passenger Transport in G20 Countries

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Annexure

1. Emission Factors

Fuel	Emission Factor (MtCO ₂ /EJ)
Oil	71.9
Gas	52.1

2. Equation for transportation demand in GCAM

The demand (D) for transportation services (passenger-km) in region r and time period t is given by the following equation:

$$D_{r,t} = D_{r,t-1} \left(\frac{Y_{r,t}}{Y_{r,t-1}} \right)^{\alpha} \left(\frac{P_{r,t}}{P_{r,t-1}} \right)^{\beta} \left(\frac{N_{r,t}}{N_{r,t-1}} \right)$$

Where Y is the per-capita GDP, P is the total service price aggregated across all modes, N is the population, and α and β are income and price elasticities, respectively.

At the mode level (i.e., cars, buses), the competition may add the time value of transportation (VOTT), as shown in the equation for the price P of mode i , in region r and time period t :

$$P_{i,r,t} = \sum_{j=1}^N (a_{j,i,r,t} * P_{j,i,r,t}) + \frac{(W_{r,t} * V_{i,r,t})}{S_{i,r,t}}$$

Here, j refers to any of N technologies within mode i , α is the share of technology j in subsector i , W is the wage rate multiplied by the “time value multiplier” V , divided by the average speed of the mode S .

3. Rationale of GCAM levers used

Lever	GCAM Parameter	Rationale
Hybrid work	Income elasticity of passenger transport demand	We assume that in the BAU, passenger transport demand grows proportionally with GDP as the demand for work-related commute increases as economies grow. However, in a scenario with increased remote work, the demand for work commute would grow slower than GDP, implying lower income elasticity.
Carpooling	Load factor of cars	The load factor of 4-wheelers represents the average car occupancy in the region in the period. We observe that as countries become richer and per capita car ownership increases, the average car occupancy drops, increasing the per capita emissions. In both the car occupancy scenarios, we explore the impact of higher car occupancy across countries, which can be achieved through an increase in carpooling trips and a decrease in single-occupancy car trips.
Public transport	Value of time in transit (VOTT) of buses	VOTT is a multiplier that considers the value of travel time in relation to a country's income and the time spent travelling in each mode of transport. By changing the

value of this multiplier, we replicate the impact of improvement in public transport infrastructure such that people have higher preference for buses.

4. Load factor assumptions (in persons per vehicle)

BAU

	2021	2025	2030	2035	2040	2045	2050
Argentina	1.83	1.83	1.83	1.83	1.83	1.83	1.83
Australia_NZ	1.58	1.58	1.58	1.58	1.58	1.58	1.58
Brazil	1.83	1.83	1.83	1.83	1.83	1.83	1.83
Canada	1.68	1.68	1.68	1.68	1.68	1.68	1.68
EU-15	1.66	1.66	1.66	1.66	1.66	1.66	1.66
Turkey	1.82	1.82	1.82	1.82	1.82	1.82	1.82
India	2.32	2.28	2.22	2.17	2.11	2.06	2
Indonesia	2.32	2.28	2.22	2.17	2.11	2.06	2
Japan	1.54	1.54	1.54	1.54	1.54	1.54	1.54
Mexico	1.83	1.83	1.83	1.83	1.83	1.83	1.83
Saudi Arabia	2.32	2.28	2.22	2.17	2.11	2.06	2
Russia	1.85	1.85	1.85	1.85	1.85	1.85	1.85
South Korea	1.46	1.46	1.46	1.46	1.46	1.46	1.46
USA	1.58	1.58	1.58	1.58	1.58	1.58	1.58

Equal Car Occupancy

	2021	2025	2030	2035	2040	2045	2050
Argentina	1.83	2.025	2.22	2.415	2.61	2.805	3
Australia_NZ	1.58	1.817	2.053	2.29	2.527	2.763	3
Brazil	1.83	2.025	2.22	2.415	2.61	2.805	3
Canada	1.68	1.9	2.12	2.34	2.56	2.78	3
EU-15	1.66	1.883	2.107	2.33	2.553	2.777	3
Turkey	1.82	2.05	2.24	2.43	2.62	2.81	3
India	2.32	2.59	2.67	2.75	2.83	2.91	3
Indonesia	2.32	2.59	2.67	2.75	2.83	2.91	3
Japan	1.54	1.78	2.02	2.27	2.51	2.75	3
Mexico	1.83	2.025	2.22	2.415	2.61	2.805	3
Saudi Arabia	2.32	2.59	2.67	2.75	2.83	2.91	3
Russia	1.85	2.05	2.24	2.43	2.62	2.81	3
South Korea	1.46	1.71	1.97	2.23	2.48	2.74	3
USA	1.58	1.817	2.053	2.29	2.527	2.763	3

50% Higher Car Occupancy

	2021	2025	2030	2035	2040	2045	2050
Argentina	1.83	1.98	2.14	2.29	2.44	2.59	2.75
Australia_NZ	1.58	1.77	1.97	2.16	2.36	2.55	2.75
Brazil	1.83	1.92	2.01	2.1	2.19	2.28	2.37
Canada	1.68	1.8	1.91	2.03	2.14	2.26	2.37
EU-15	1.66	1.8	1.91	2.03	2.14	2.26	2.37
Turkey	1.82	1.91	2	2.1	2.19	2.28	2.37
India	2.32	2.39	2.46	2.53	2.6	2.67	2.75
Indonesia	2.32	2.39	2.46	2.53	2.6	2.67	2.75
Japan	1.54	1.74	1.94	2.14	2.34	2.54	2.75
Mexico	1.83	1.98	2.14	2.29	2.44	2.59	2.75
Saudi Arabia	2.32	2.39	2.46	2.53	2.6	2.67	2.75
Russia	1.85	1.96	2.07	2.19	2.3	2.41	2.52
South Korea	1.46	1.64	1.81	1.99	2.17	2.34	2.52
USA	1.58	1.74	1.89	2.05	2.21	2.36	2.52