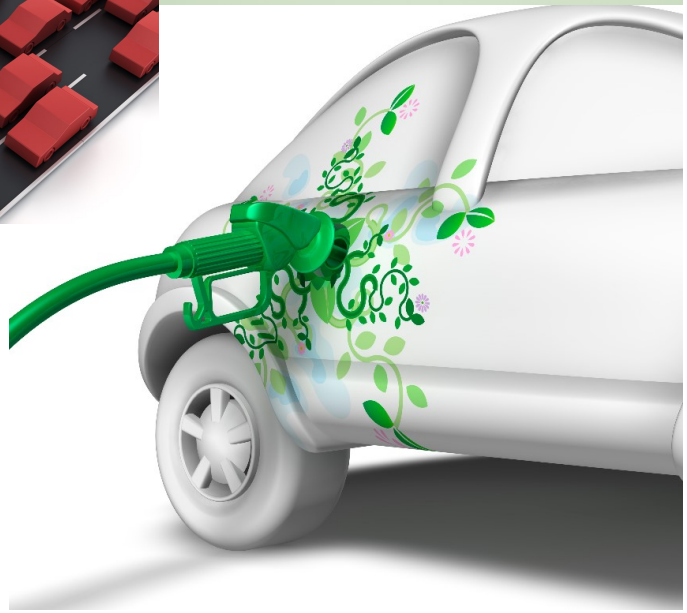
Decarbonising Transport: Beyond Cars and Internal Combustion Engines



Anumita Roychowdhury
Sayan Roy, Anannya Das, Shubham Srivastava and Shantanu Gupta

Centre for Science and Environment

December 17, 2020

Grim reminder

UNEP Emissions Gap Report 2020:

- Pandemic-linked economic slowdown to cause 7% drop in CO2 emissions this year. Translates to a 0.01°C reduction of global warming by 2050.

- Insignificant impact on the Paris Agreement goal of limiting global warming to well below 2°C, and pursuing 1.5°C.
-
- Need green recovery to reduce upto 25% emissions in 2030 with unconditional implementation of nationally determined contributions (NDCs) under the Paris Agreement –to be closer to the 2°C pathway.

- Otherwise heading for a 3.2°C warmer world by the end of this century…

Climate change threat is real

And the need for action is urgent

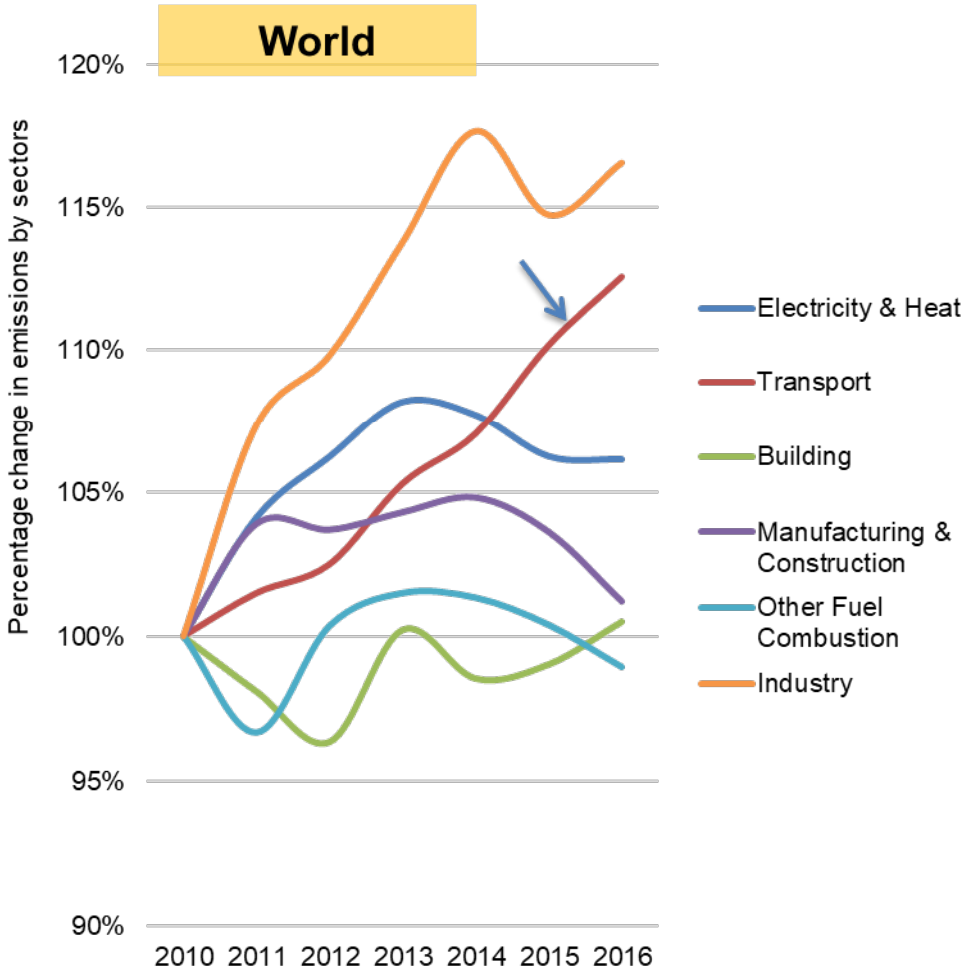
Climate change is real; impacts are catastrophic

World needs effective, ambitious and equitable actions

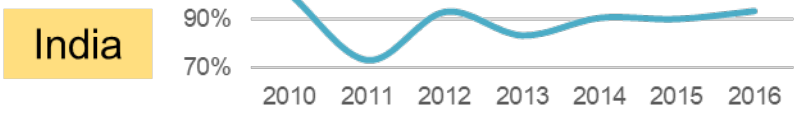
Transport sector – a special challenge

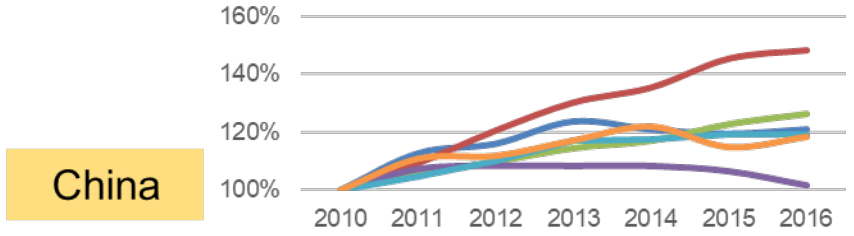
The question: is the world doing enough?

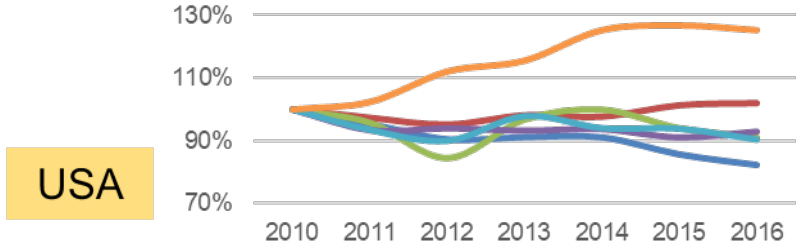
CO2 emissions from transport sector: Obstinate

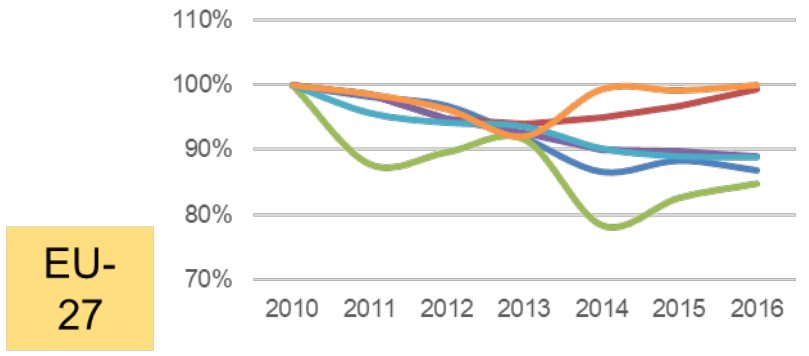


Source: ourworldindata.org

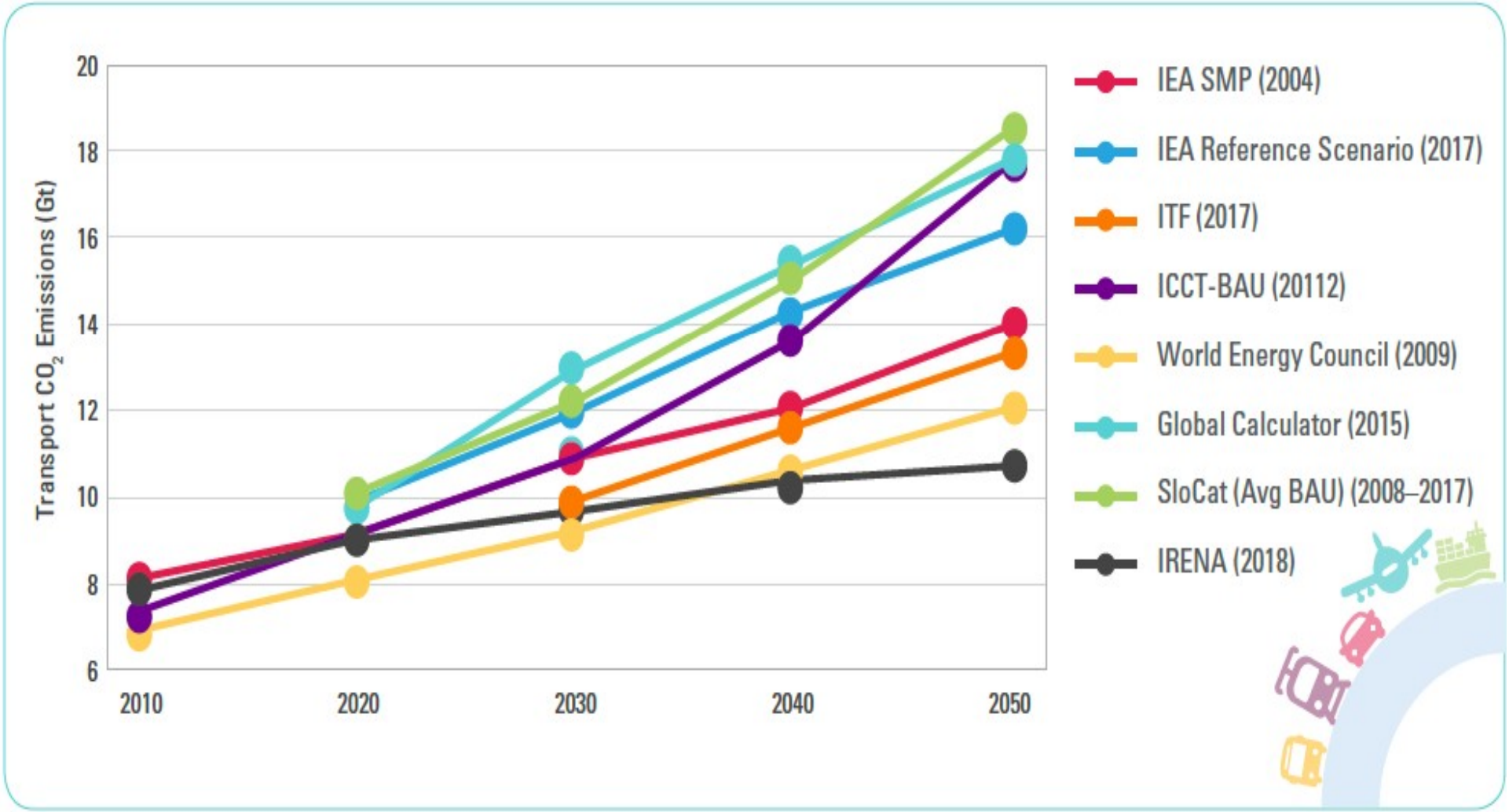








Transport: Business-as-Usual CO2 Emissions(2050)



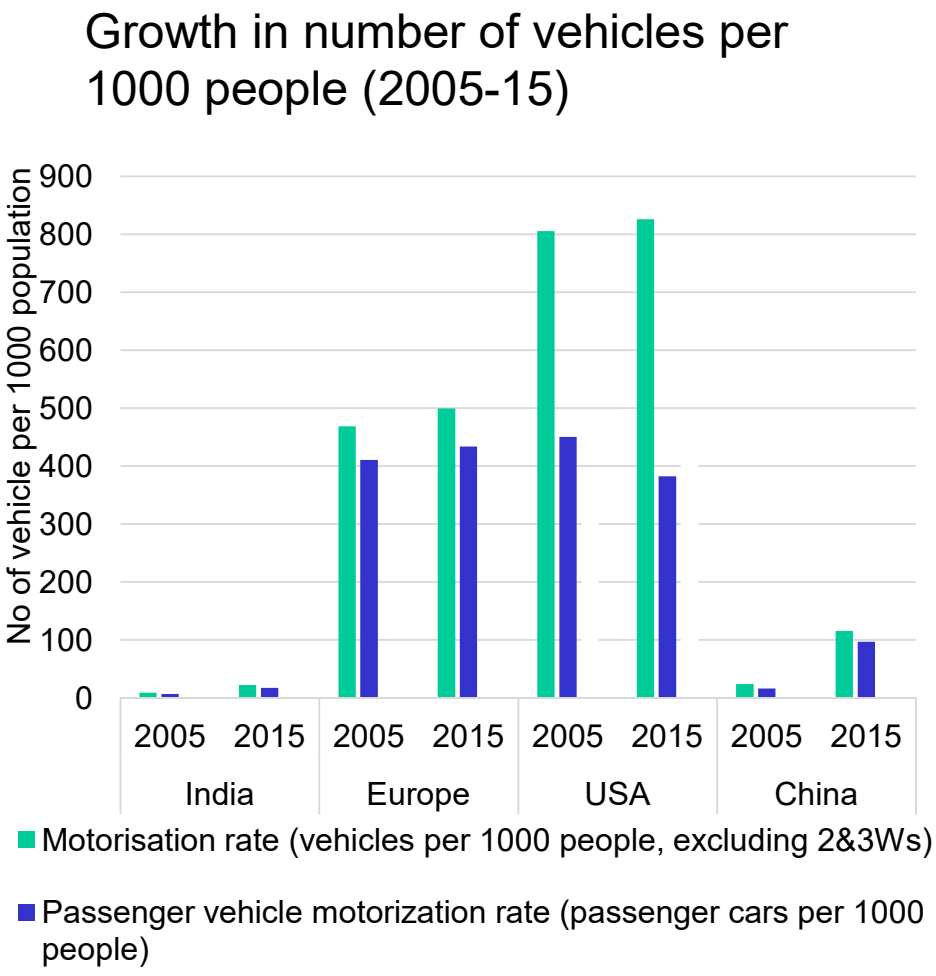
Source: Slocat 2016

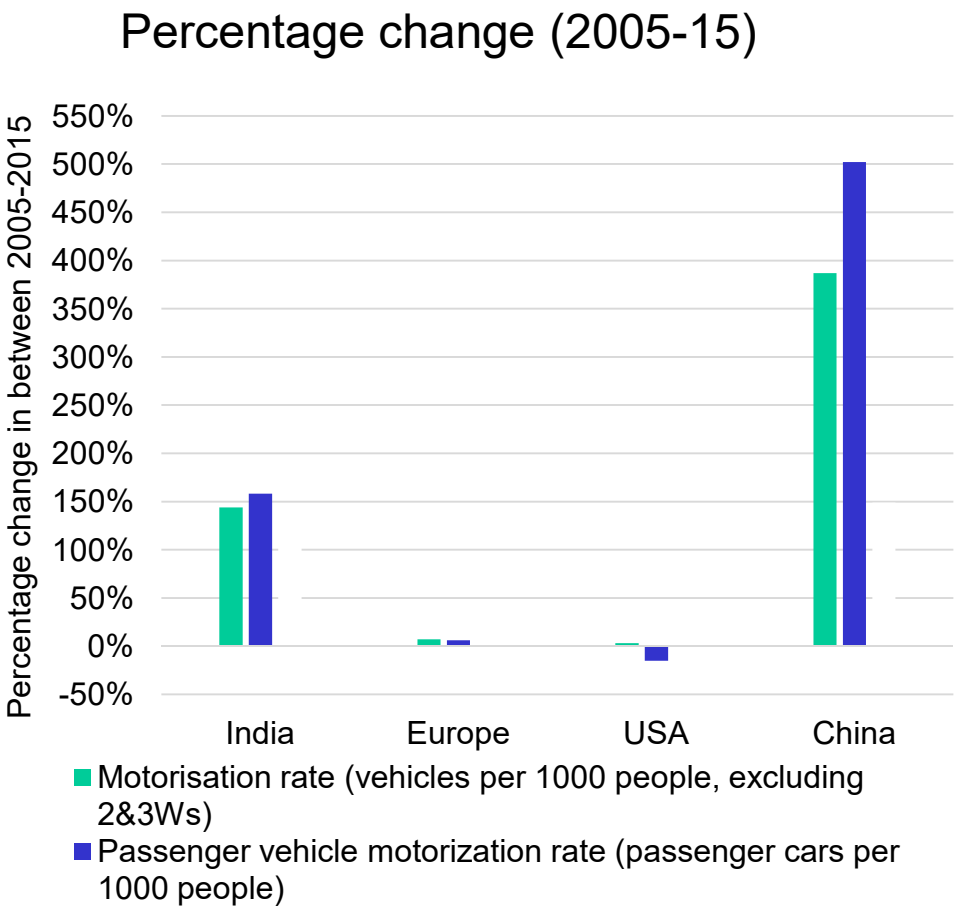
Bullish despite improvement

Tracking Transport 2020 – IEA:

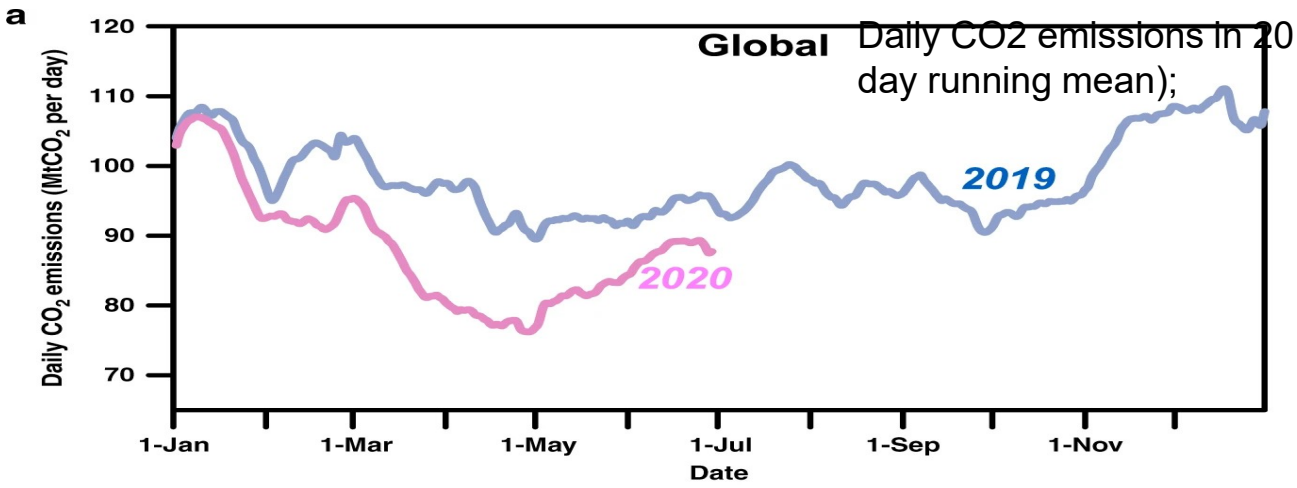
- Global transport emissions increased by less than 0.5% in 2019 (compared with 1.9% annually since 2000)
- Global transport sector energy intensity (total energy consumption per unit of GDP) dropped by 2.3% in 2019 after falling an average 1.4% per year between 2000 and 2018. But still close to a quarter of direct CO2 from from fuel combustion
- **But energy intensity must drop by 3.2% on average annually from 2020 to 2030** – more than double the annual average rate of decrease since 2000
- Road vehicles account for **nearly three-quarters of transport CO2 emissions**
- Emissions from aviation and shipping continue to rise. Need international policy focus on these hard-to-abate subsectors.

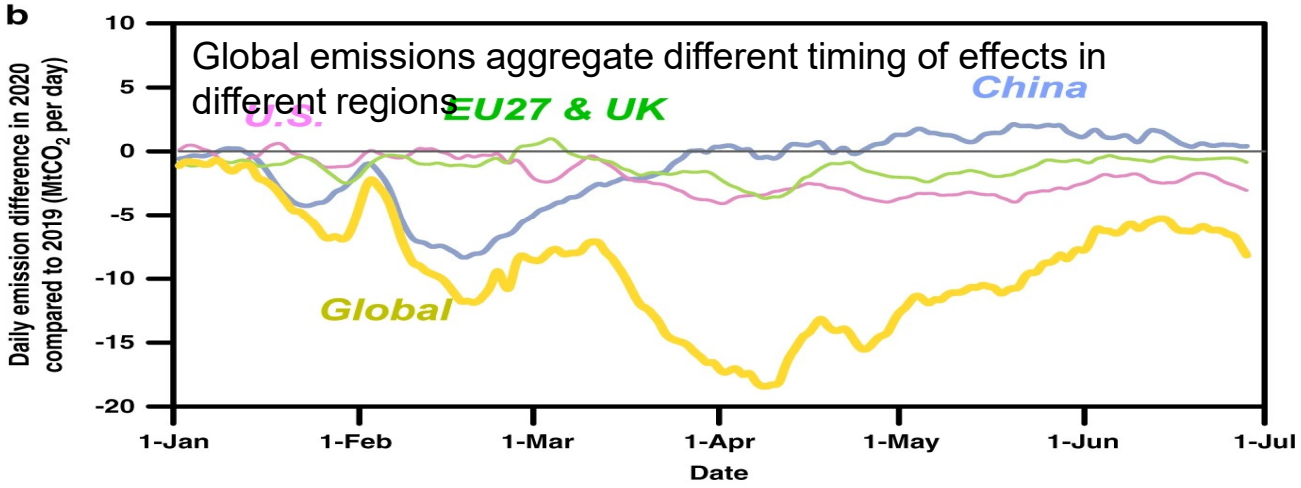
Growth rate vs absolute

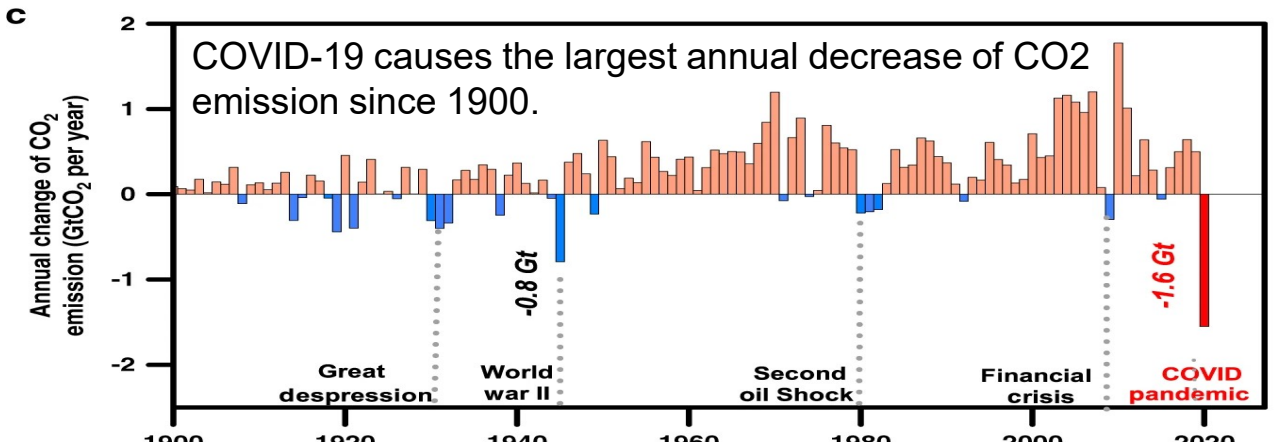




Source: Based on Slocat 2016





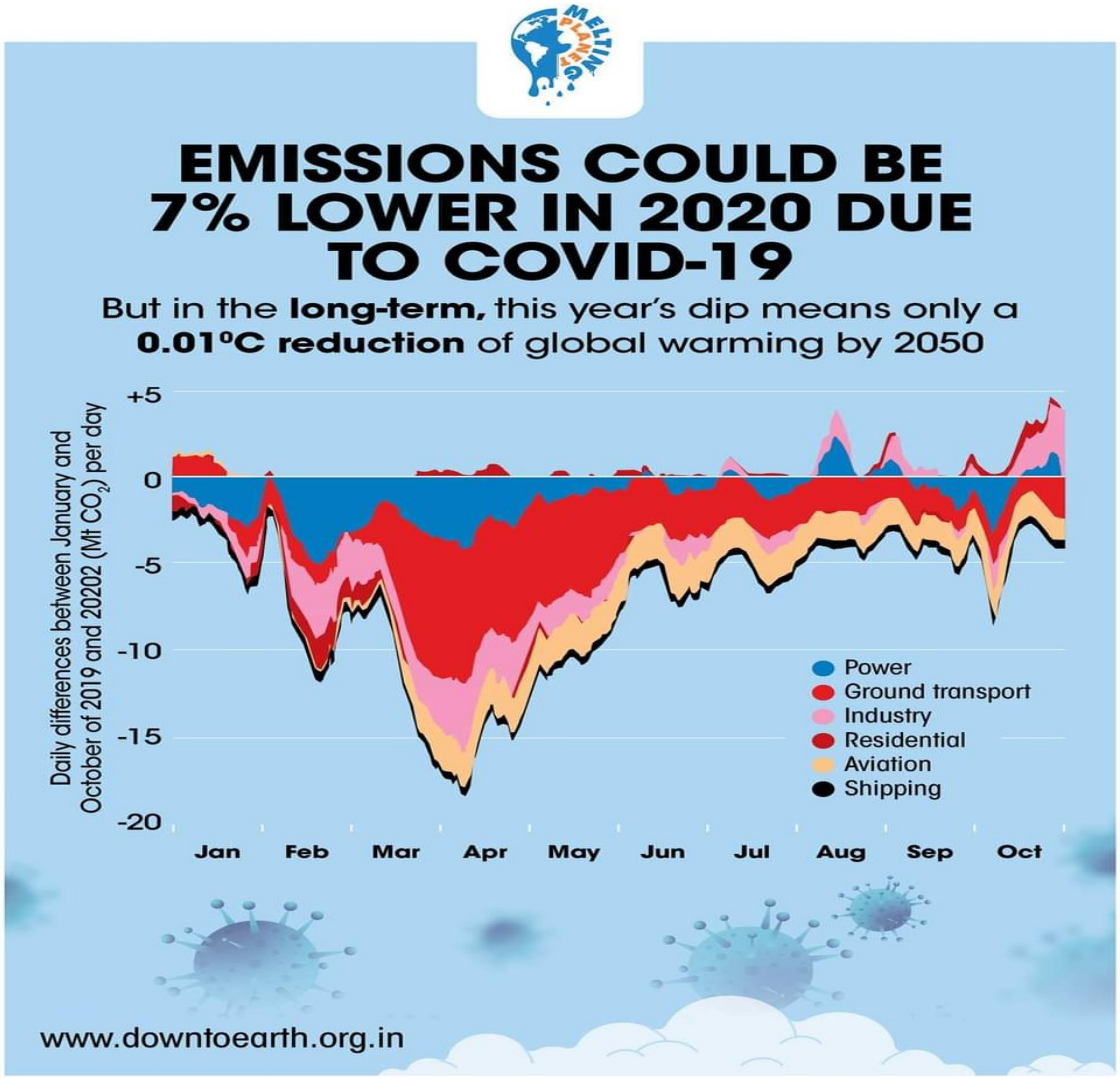


Effects of COVID-19 on global CO2 emissions:

From: Near-real-time monitoring of global CO2 emissions

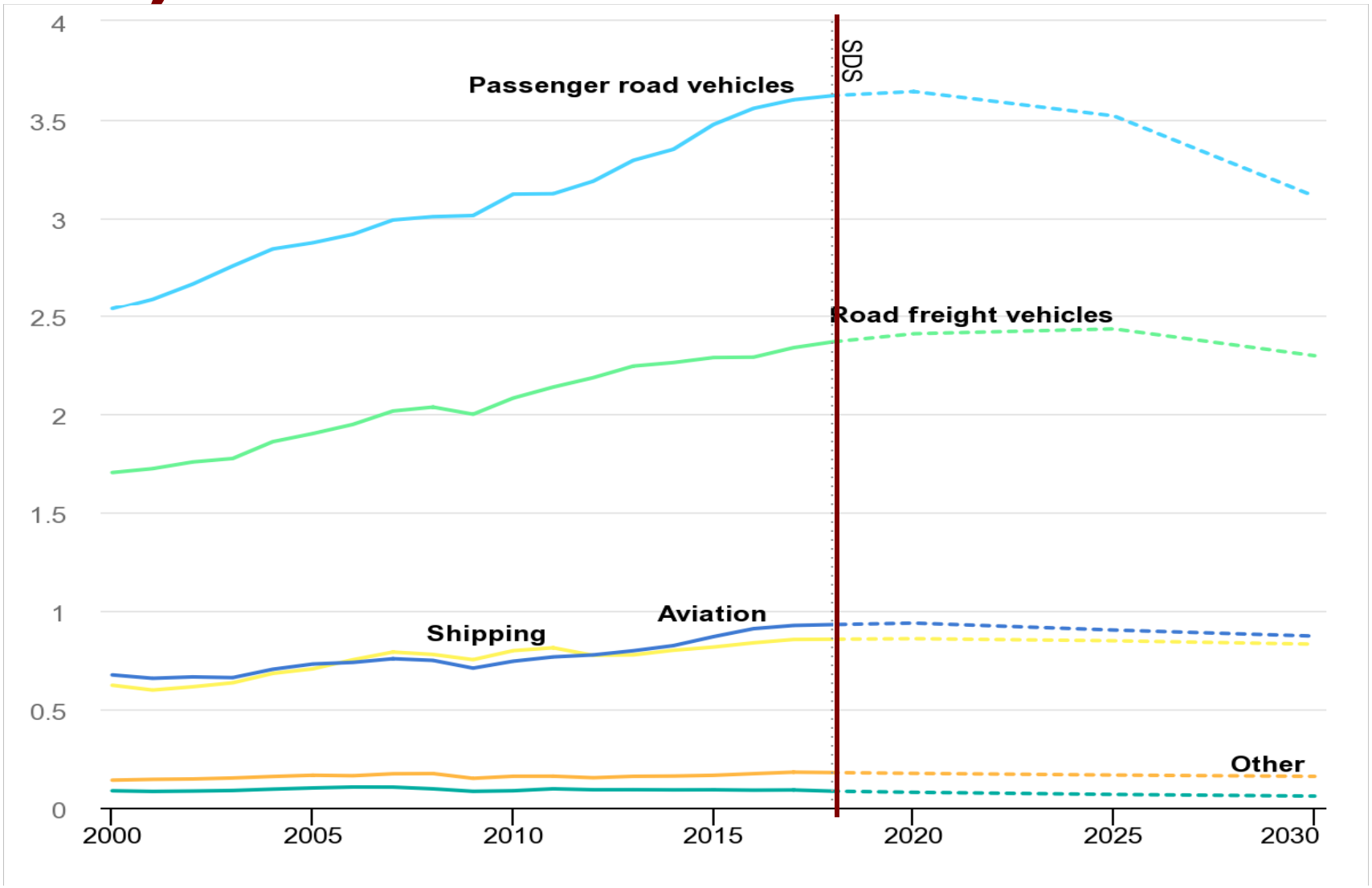
Pandemic and transport CO2: Nose dives; but recovers

Emissions Gap report 2020



Source: Emissions Gap Report, 2020 | UNEP

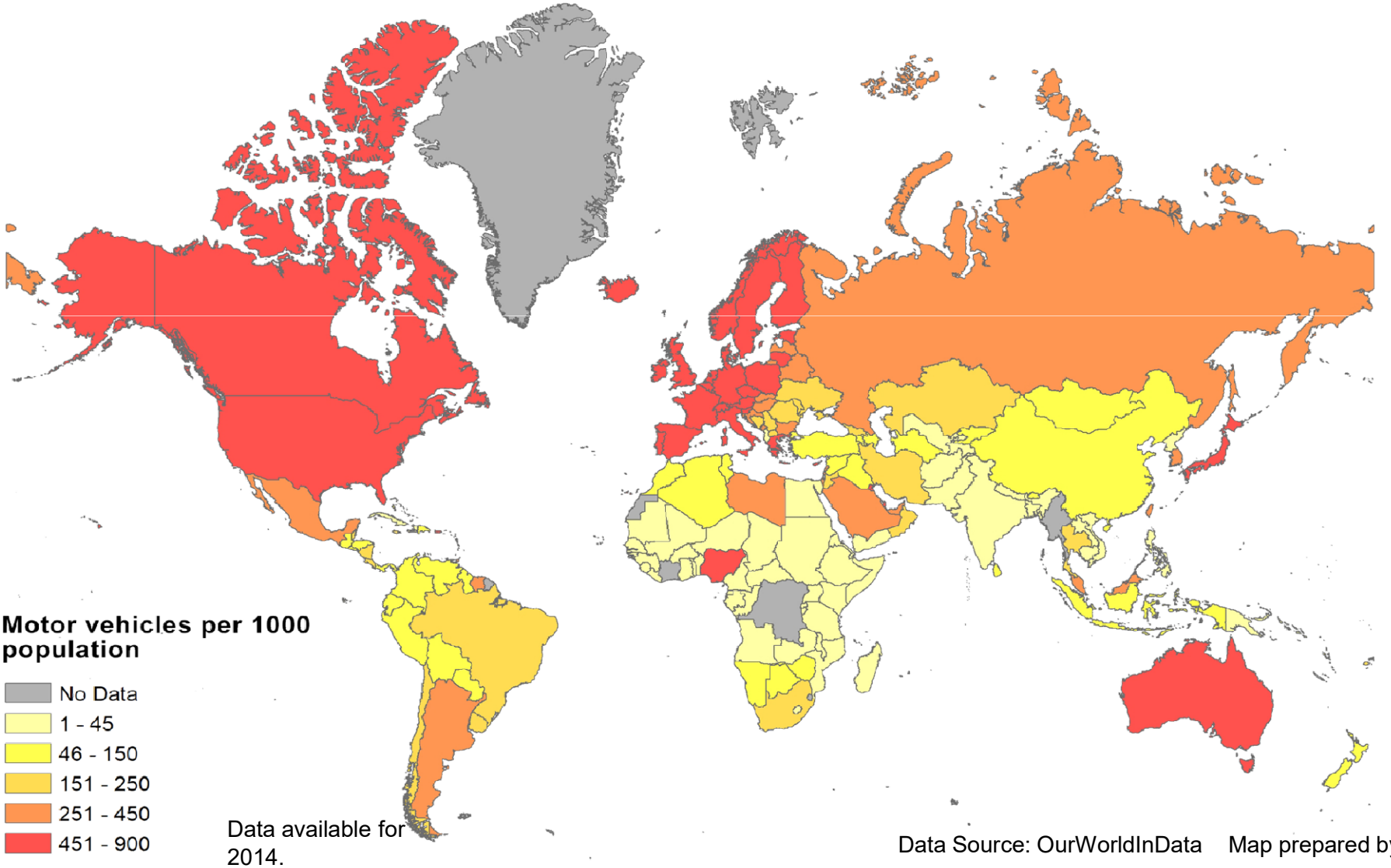
Inflexion point: Scenario for future cut (2000-2030)



How will world address this challenge?

Legacy challenge of car locked world

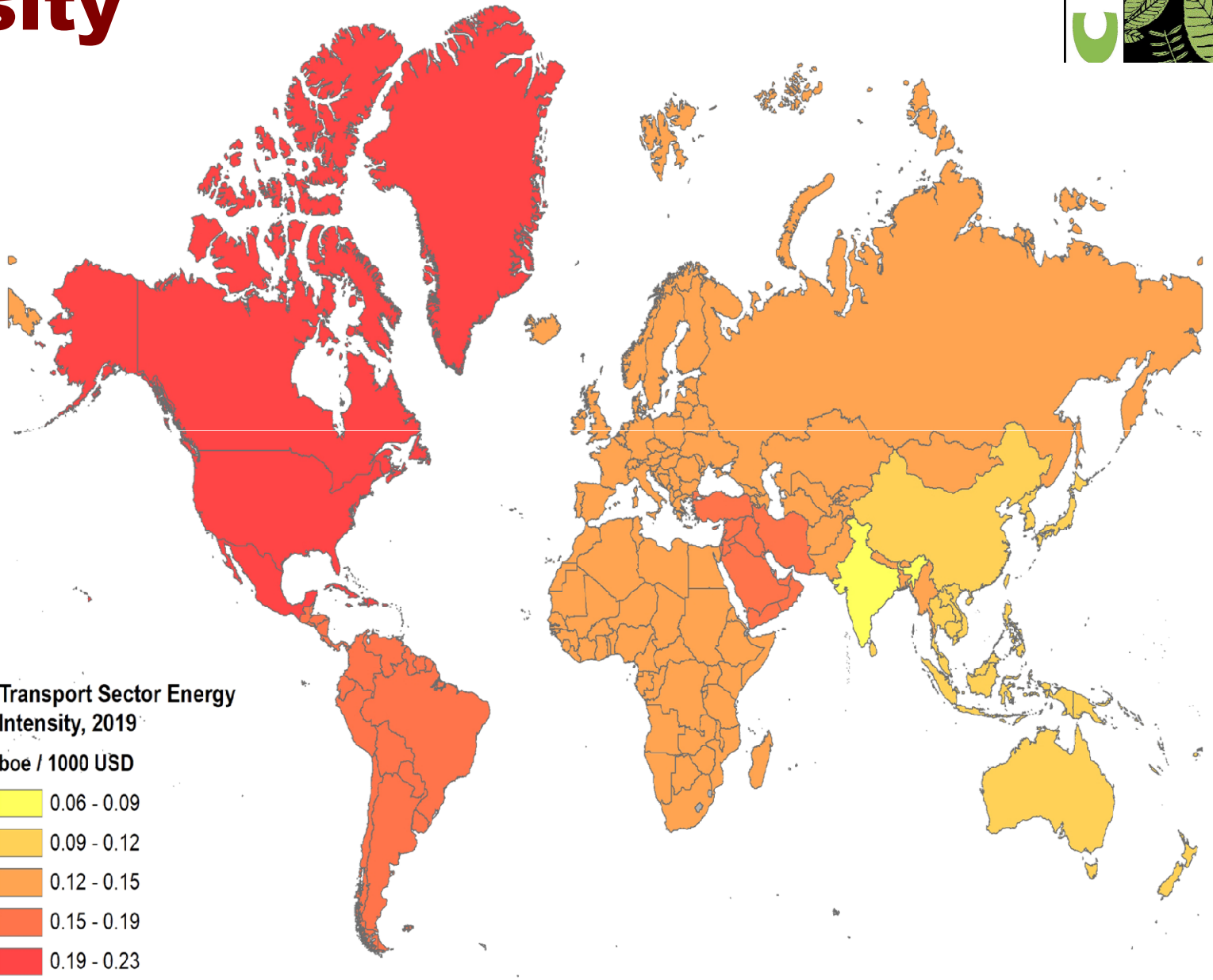
Motor vehicle ownership per 1000 population



Data available for 2014.

Data Source: OurWorldInData Map prepared by CSE

Global transport energy intensity



Energy intensity: Total energy consumption per unit of GDP.

Boe:- barrels of oil equivalent

Data Source: IEA, 2019

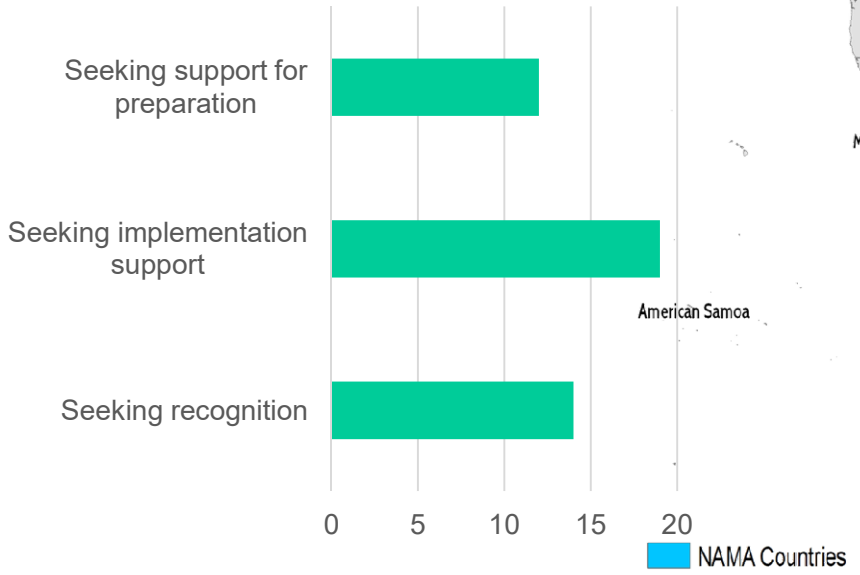
Map prepared by CSE

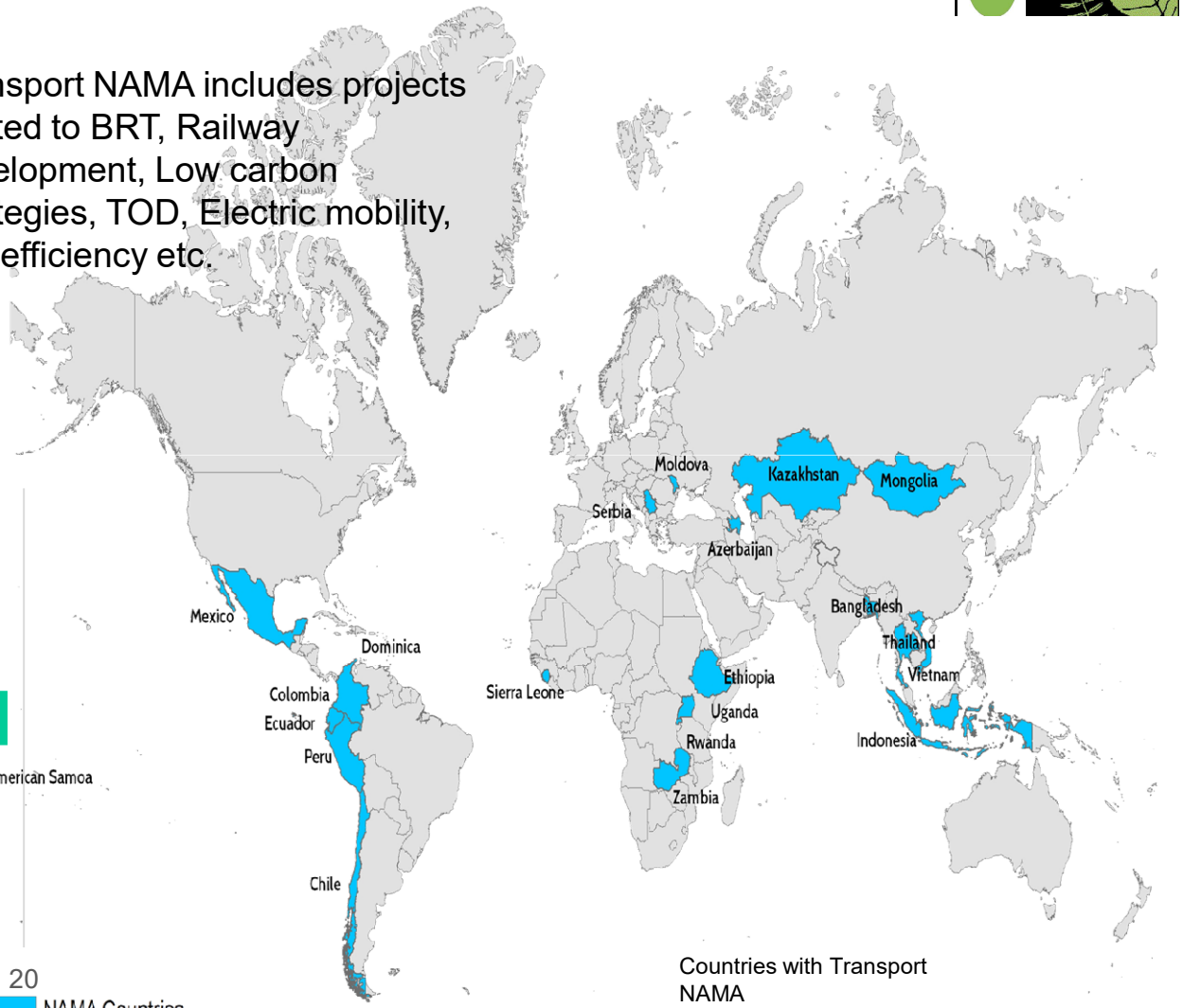
Not many NAMAs with transport focus

31 NAMAs that include transport strategies

22 NAMAs only on transpor

- Transport NAMA includes projects related to BRT, Railway development, Low carbon strategies, TOD, Electric mobility, fuel efficiency etc.





Countries with Transport NAMA

Data Source: UNFCCC NAMA Registry Map prepared by CSE

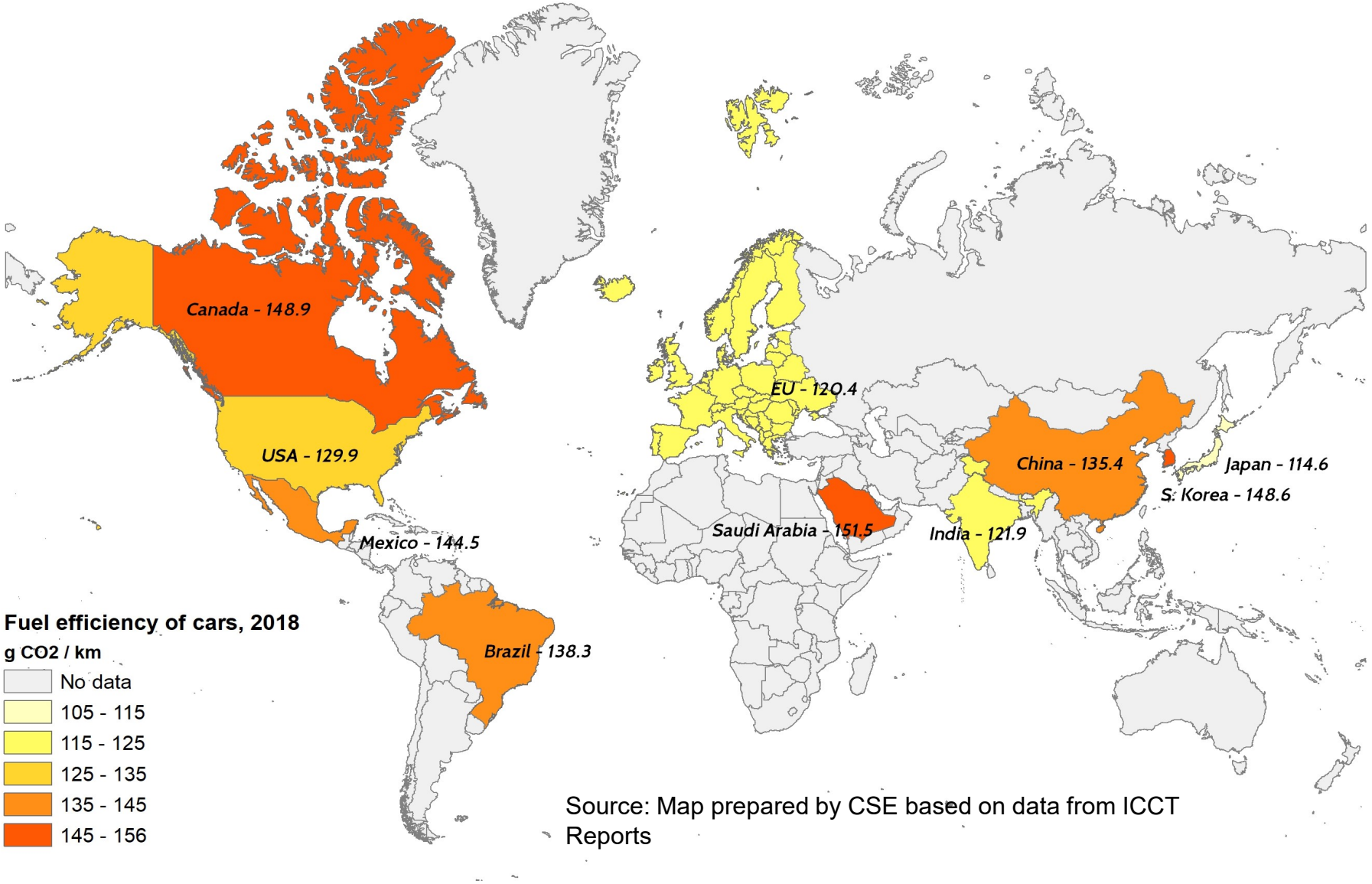
Technology pathways

- **Ambitious target for fuel efficiency**
- **Electrification and going beyond IC engines**
- **Action on international transport**

Global status 2018:

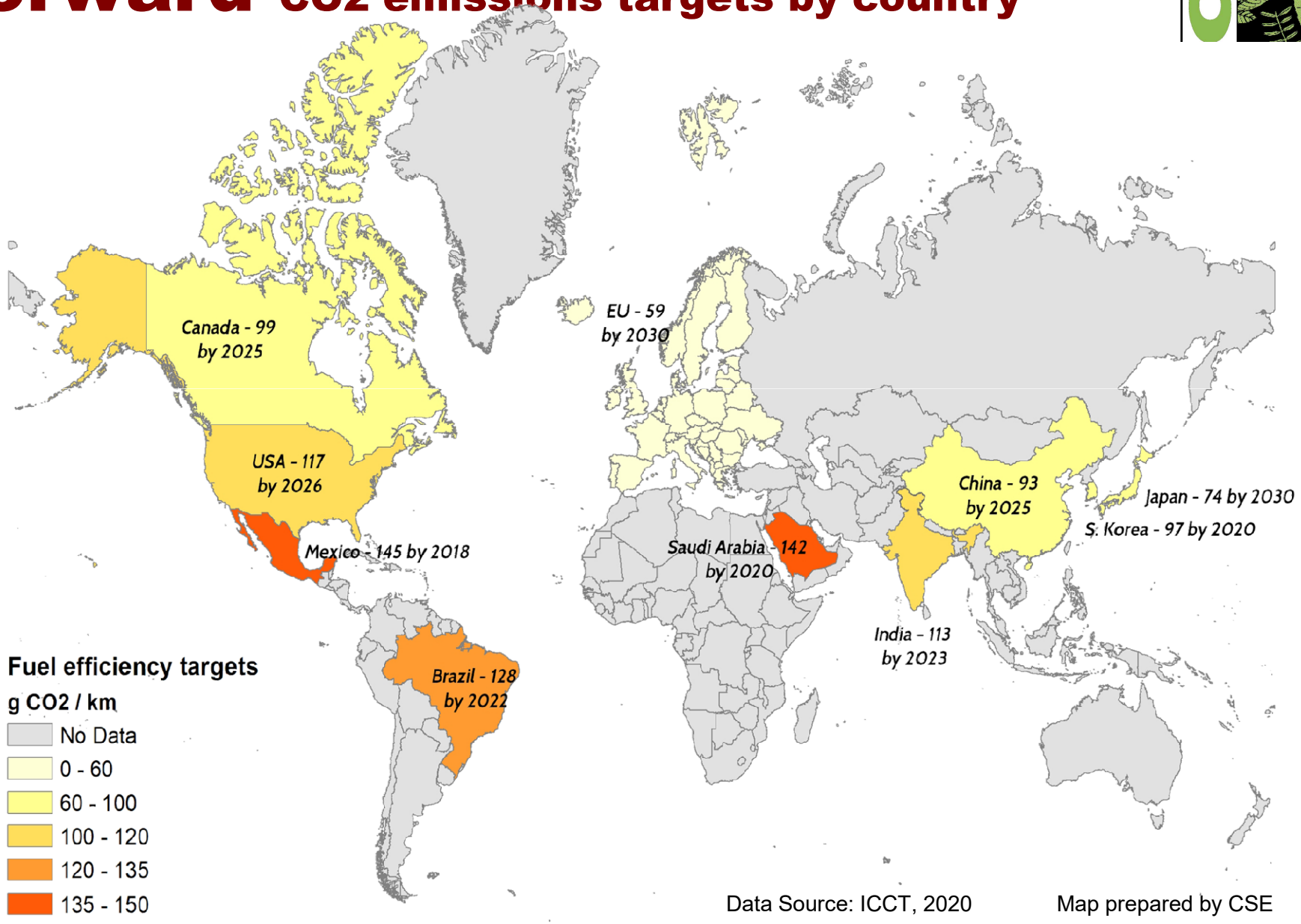
Passenger light duty vehicles CO2 emissions values in gram per km

Reflects fuel efficiency targets set by different countries



Source: Map prepared by CSE based on data from ICCT Reports

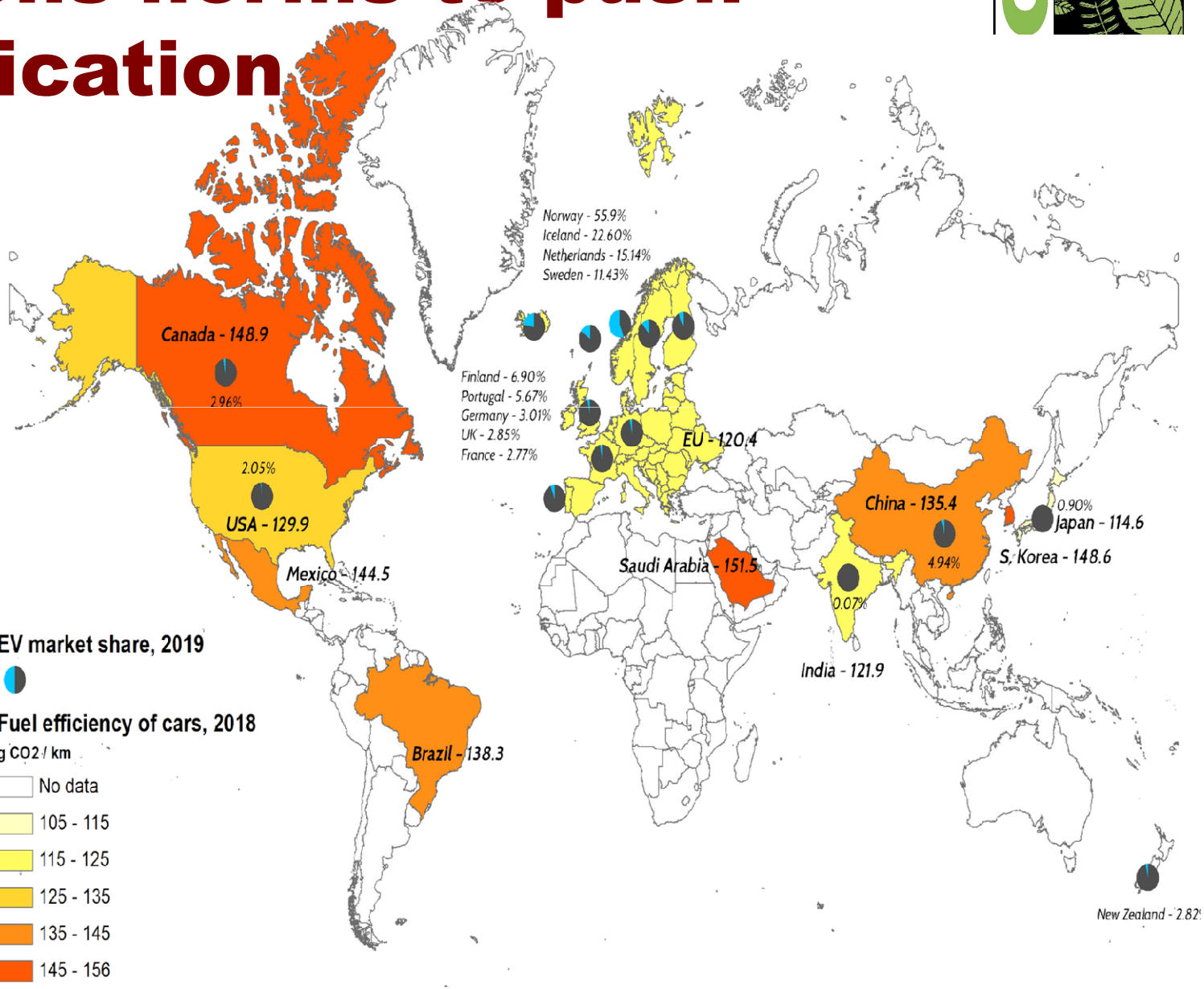
How countries are moving forward CO2 emissions targets by country



Data Source: ICCT, 2020

Map prepared by CSE

Europe leveraging tighter CO2 emissions norms to push electrification

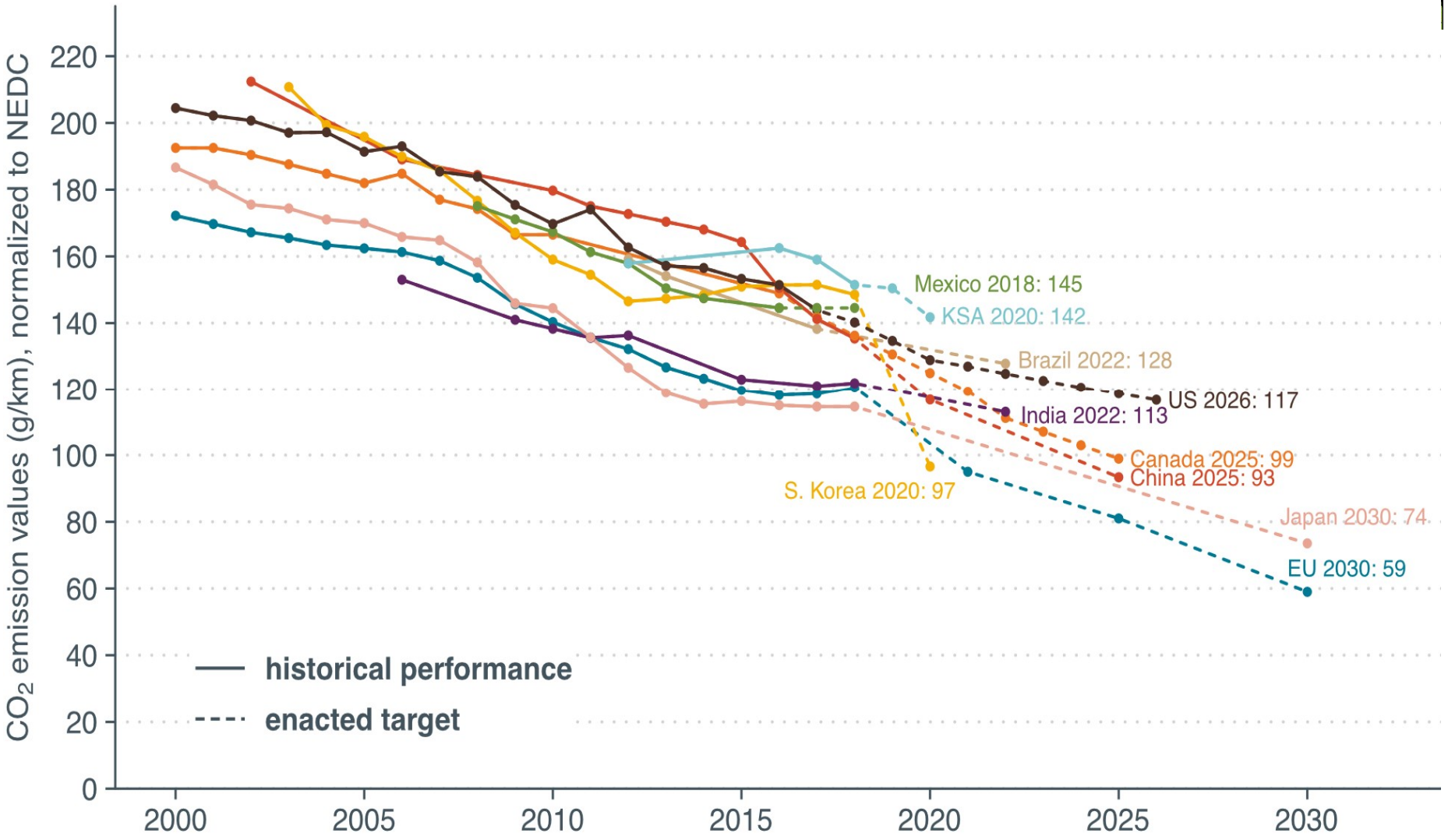


Fuel efficiency data for Canada, data available for 2016; for Mexico, 2016; for Brazil, 2017; and for the rest, 2018.

Data Source: IEA, 2019 and ICCT, 2020
Map prepared by

The race: Targets

CO2 equivalent fuel economy standards for light duty vehicles



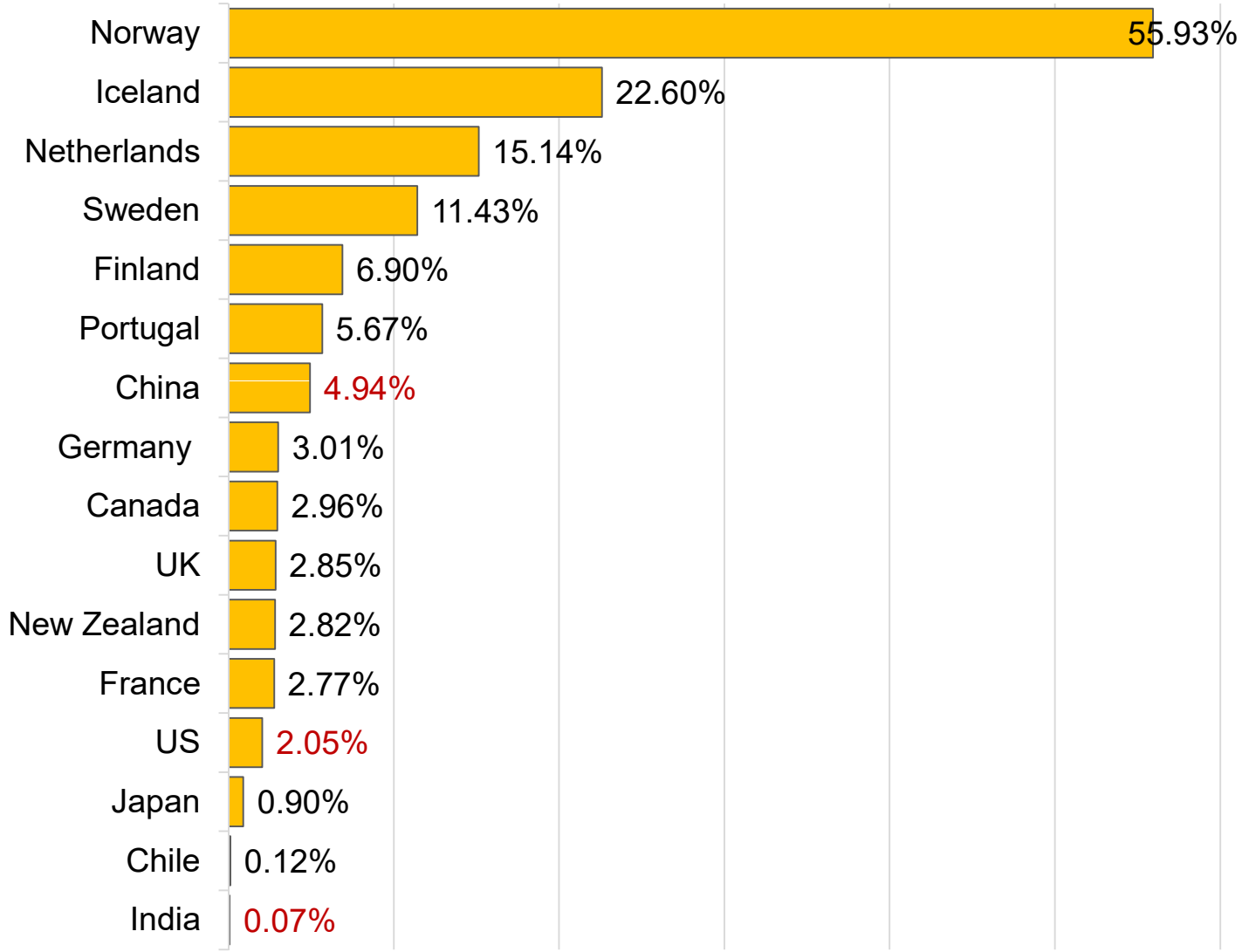
Source: ICCT

Updated May 2020

The EV race

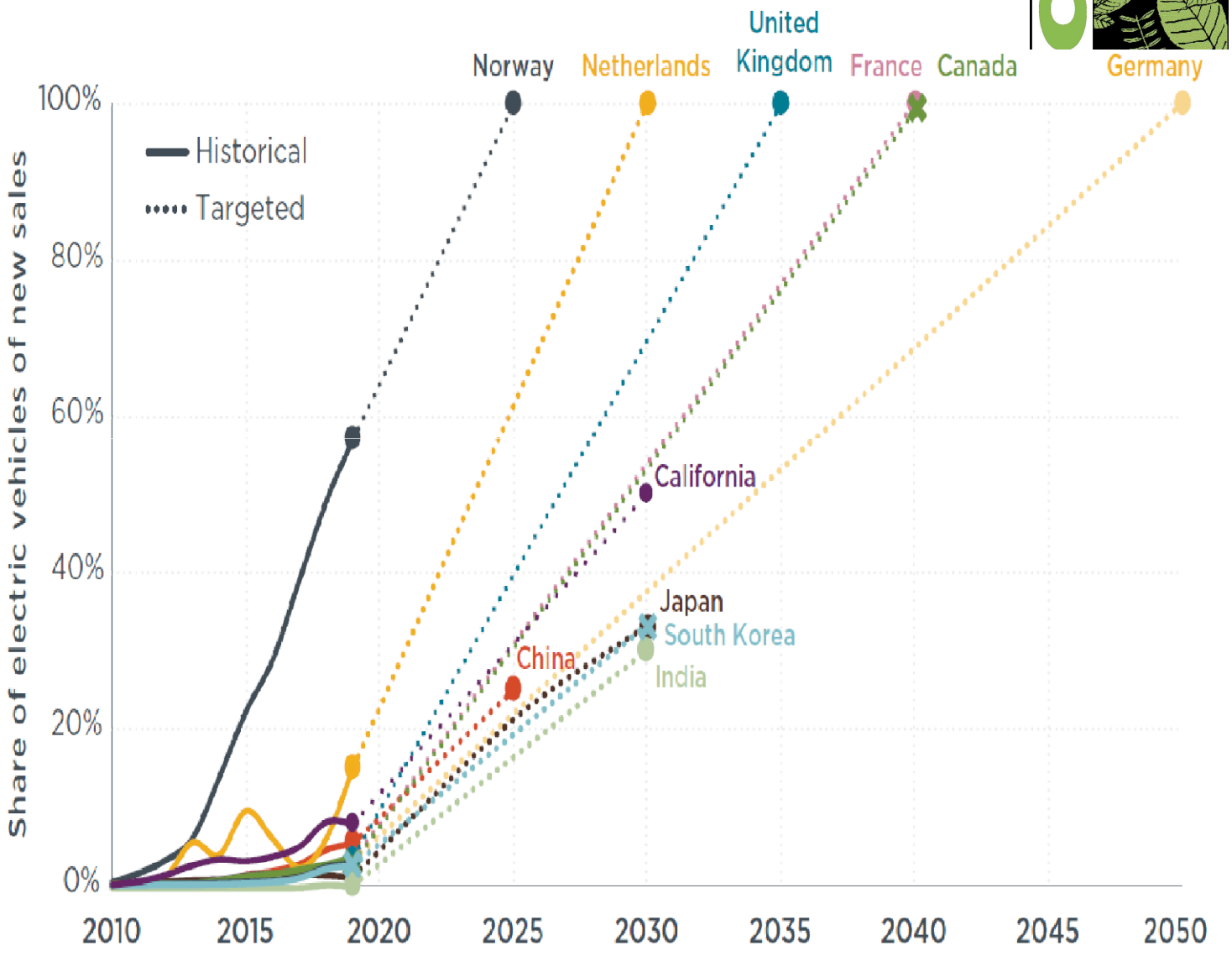
Till date, the penetration of EV is less than 5% in big global vehicle markets

70% of Evs in in few countries



100 per cent EV ambitions

Many developed nations like Norway UK, France, Germany has already set up 100% EV transformation targets.

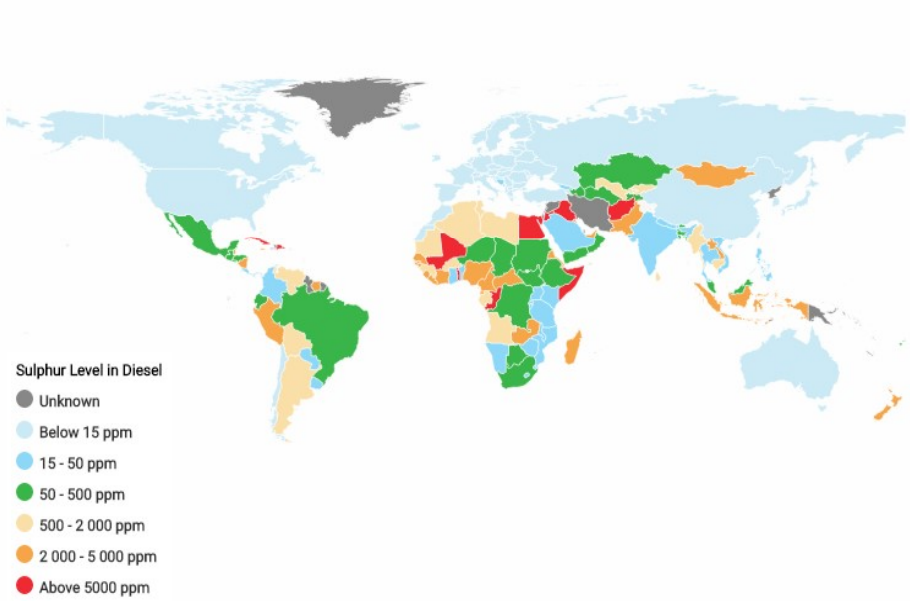


Source: ICCT Reports

Challenge of developing countries

Emissions standards and fuel quality roadmap continues to improve

Diesel fuel quality in Africa



2020: India -- BSVI emissions standards
Asia in varying stages

Africa:
2015 - 2019: East Africa Community (EAC) adopted low sulphur diesel fuel standards (of 50 parts per million or less). Also adopted low sulphur petrol fuels (also 50ppm)

2020, ECOWAS: From January 2021 only used vehicles meeting Euro IV standadrs will be permitted in 15 Ecowas countries following their adoption of new fuels and vehicle standards
Discussing electric mobility

Source: UNEP

Source: Anon. 2015, Vehicles in-use 2015 data, International Organization of Motor

India's challenge

Need high ambition for electrification – set target, zero emissions mandate, FAME III for well strutured longer term incentives and state level action

Aggressive improvement in fuel efficiency – Need stronger targets across vehicle segments – light and heavy duty and two wheelers

Decarbonise transport fuels

How can we build ambition to ensure green recovery?

Agenda: clean vehicles but also less vehicles on road

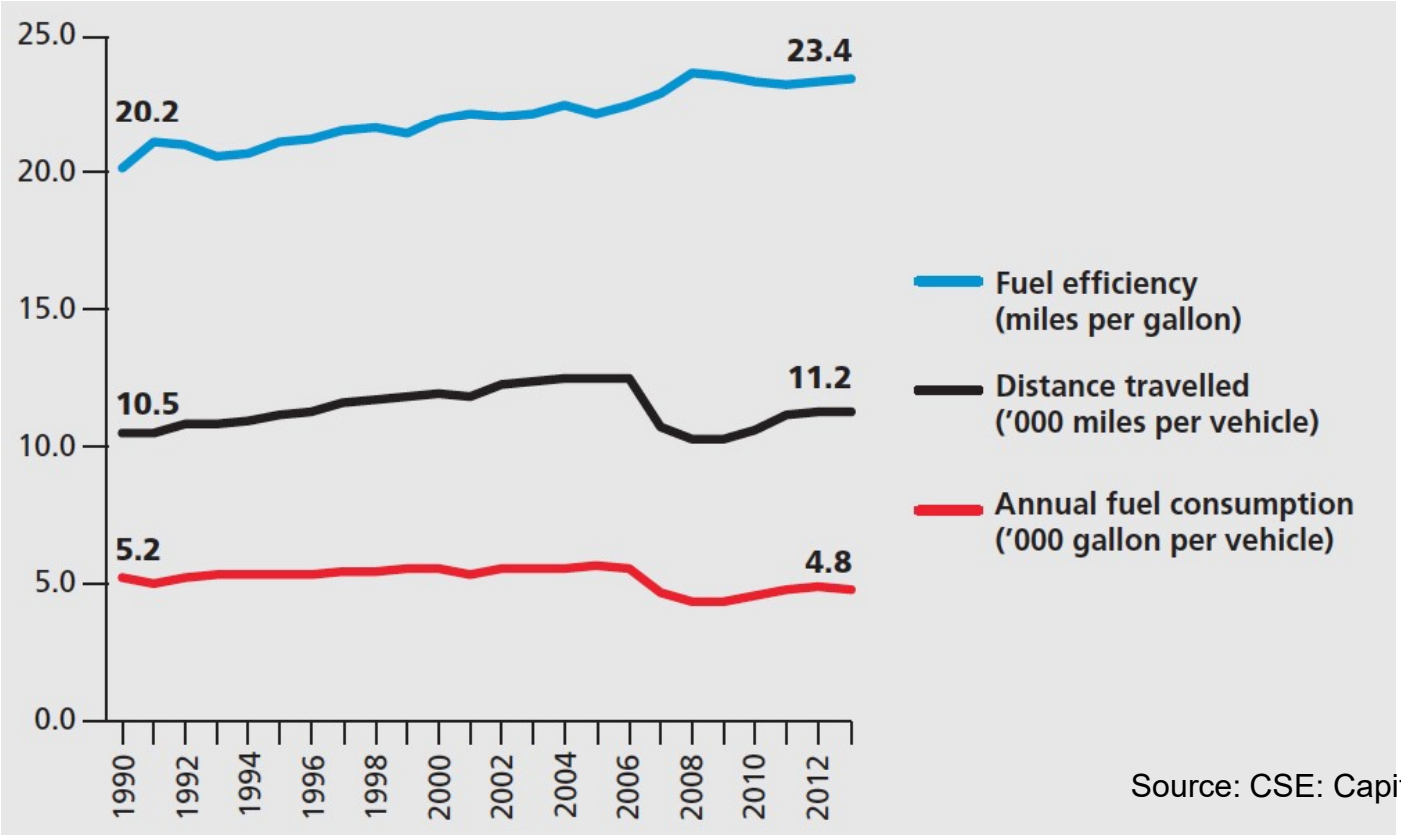
Mobility transition

Transportation and vehicle restraint strategies

Are we getting there?

Efficiency is not sufficiency: Fuel efficiency improved 16%; same period distance travelled increased 7%; gains lost

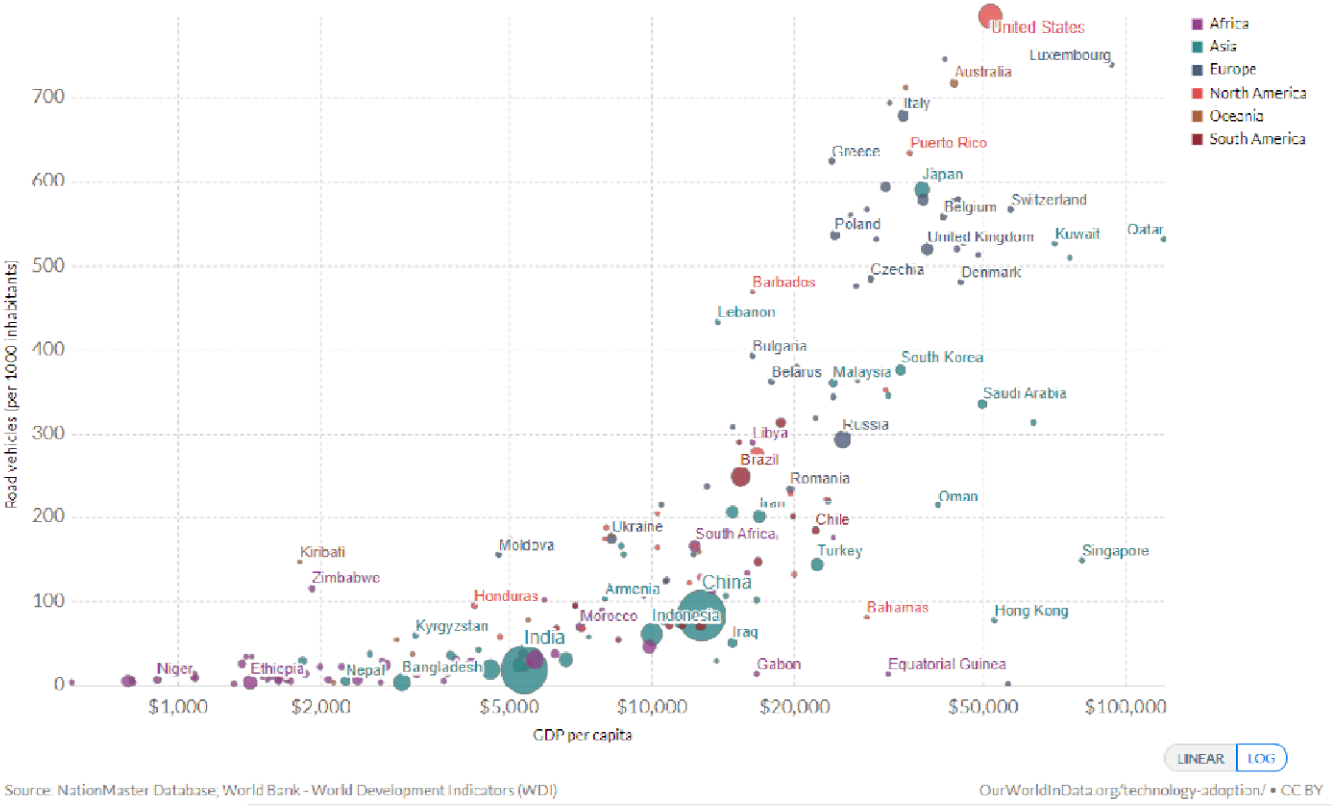
Lesson from the US



Source: CSE: Capitan America

Income and motorisation

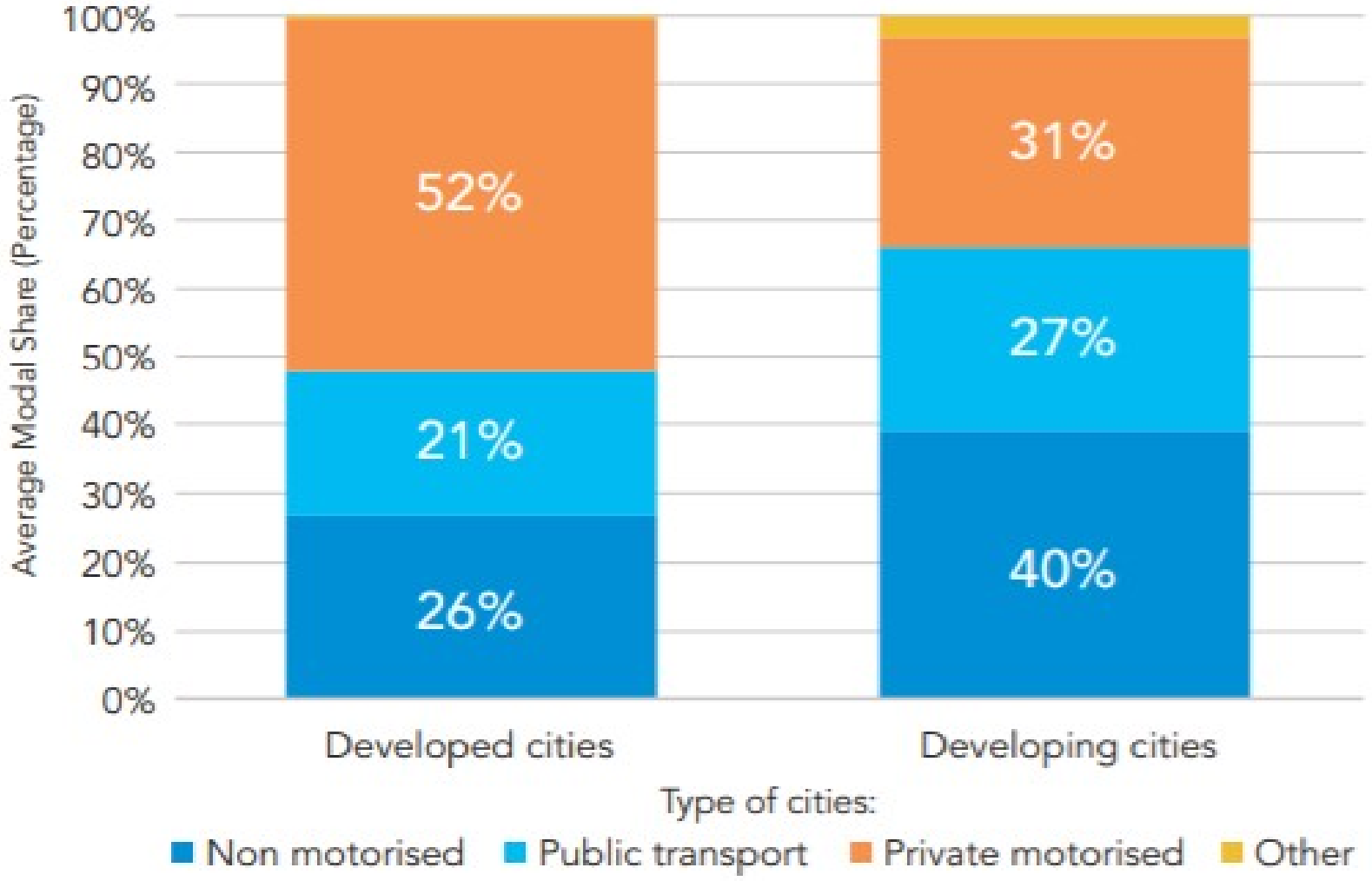
Motor vehicles per 1000 inhabitants vs GDP per capita



- Need to understand peak travel trend in developed and developing countries
- Possible for LDV travel per capita in OECD countries to peak around 2035 (IPCC)
- Non-OECD countries: likely continue to increase dramatically from a very low average today.

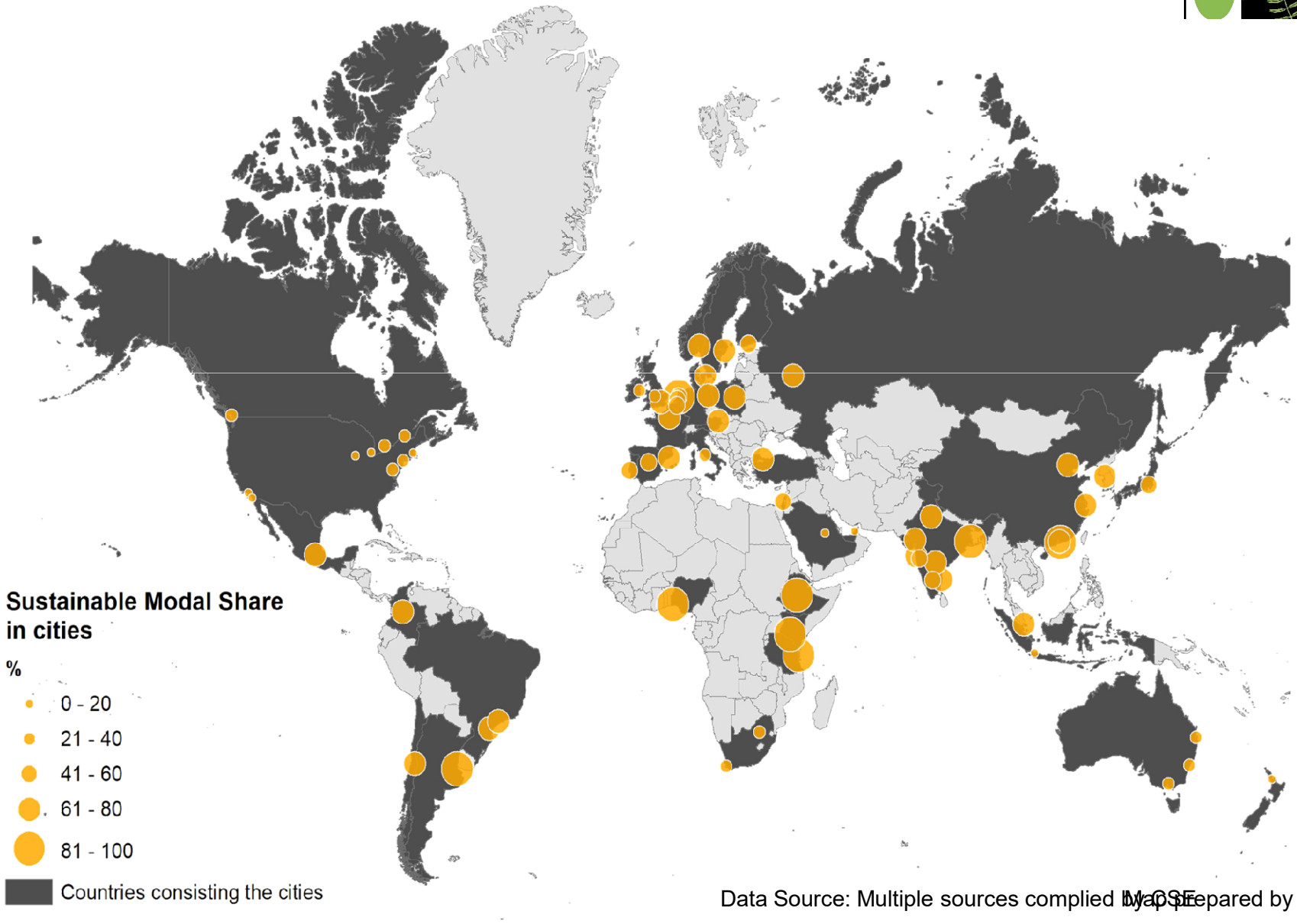
Global commuting pattern

More walking and cycling in developing world



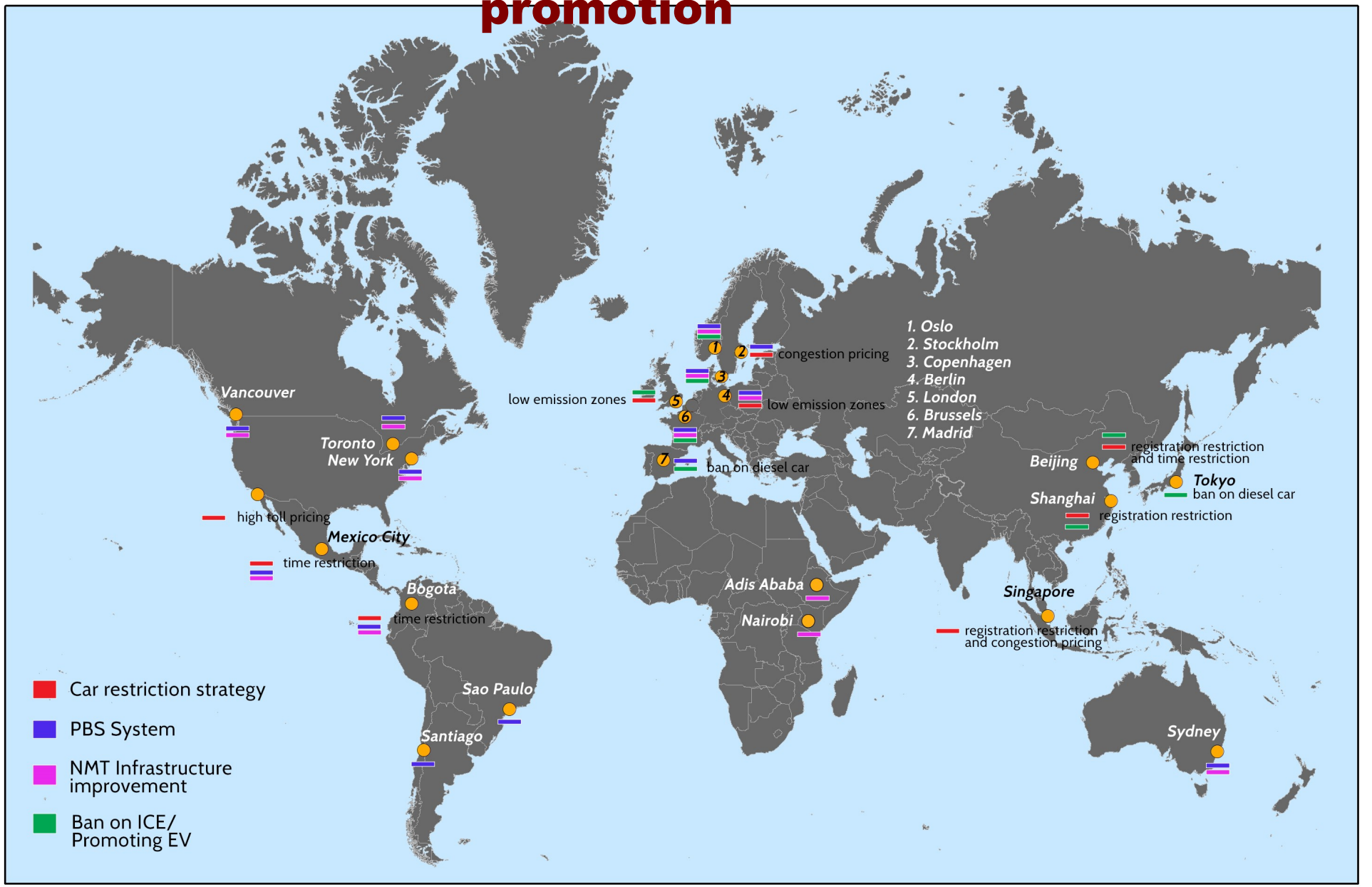
Source: UITP Mobility in Cities Database

Global pattern in sustainable mode share (Public transport+walk+cycle)



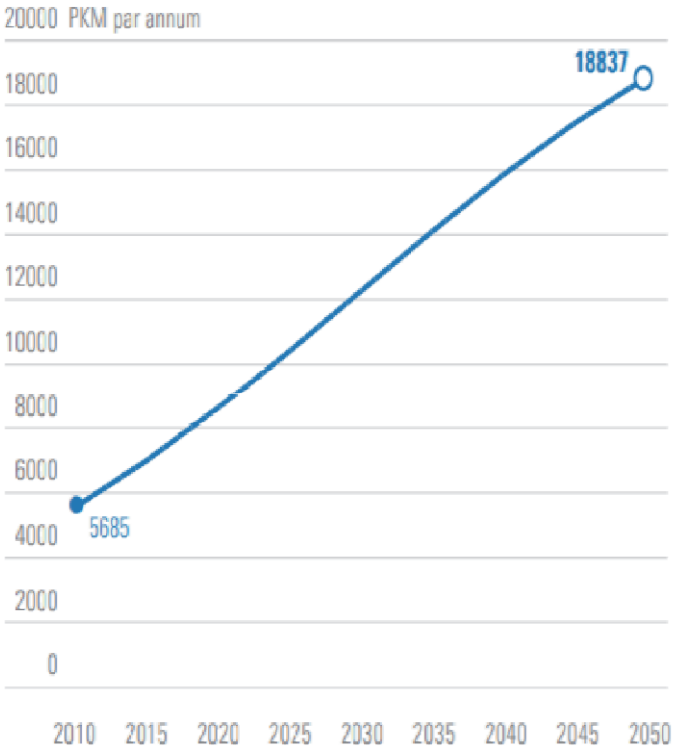
Data Source: Multiple sources complied by CSE Map prepared by CSE

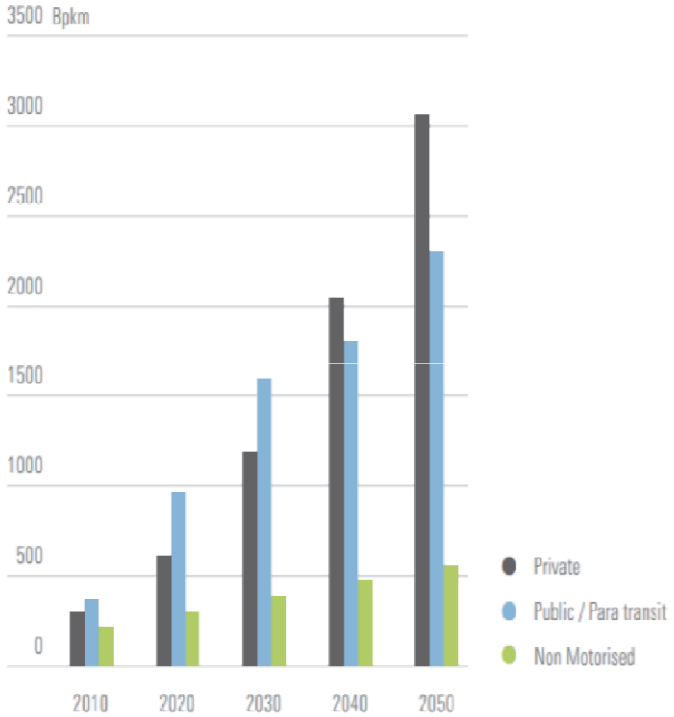
Global approaches changing to promote sustainable alternatives to car travel + EV promotion



Mobility demand in India

Increase in passenger km per annum and by mode in business-as usual scenario





Source : Dhar & Shukla, 2015

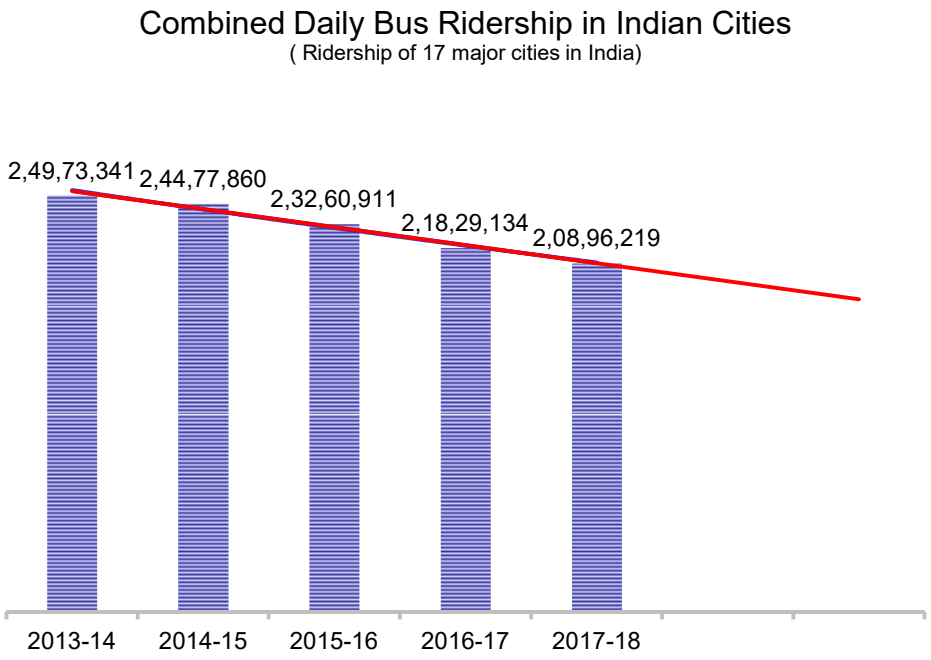
- Passenger km is expected to increase more than 3 times by 2050.
- Trip length and rate will also increase as city size and income increase

- Demand for different mode of transport will increase over time. Without adequate public and para transit, private transport will overtake public transport mode share by 2040.

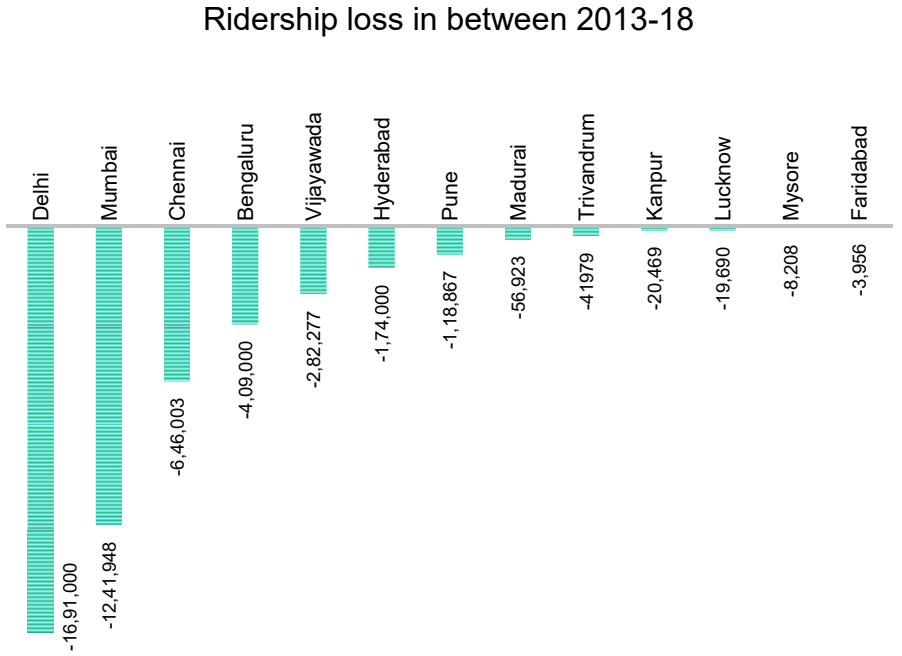
Source: UNEP, 2015

How can India rebuild bus transport?

Bus ridership declining in major cities of India



Source: RTI filed by CSE, 2019

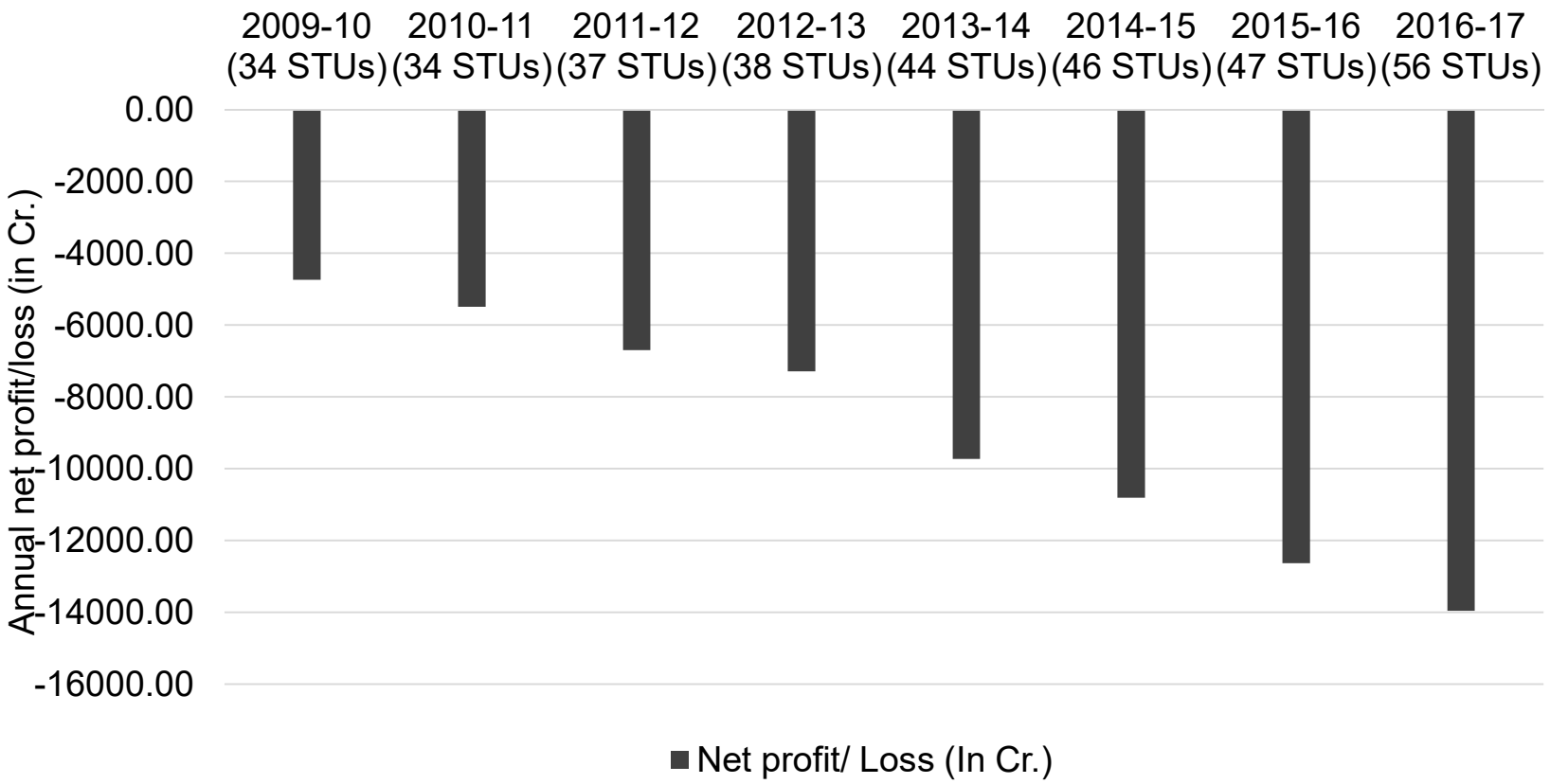


Source: RTI filed by CSE, 2019

Between 2013 - 18, 12 cities have lost combined ridership of 40.8 lakhs

NTDPC report: Passenger traffic will grow by 15-16 times over a economic growth of 7-9% per annually; India needs to invest 8-10% of GDP in transport infrastructure

STUs: Growing financial burden

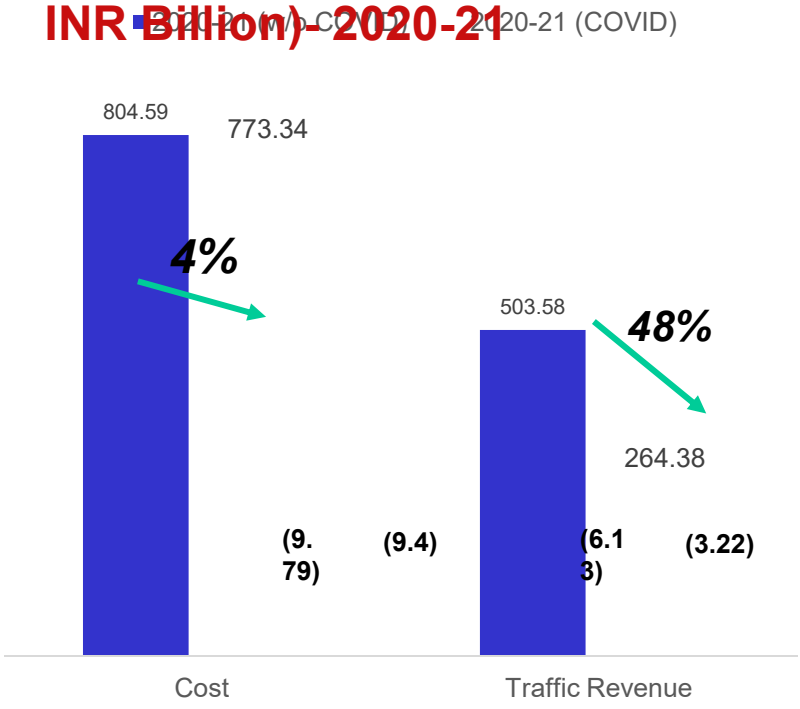


Source: Annual performance reports published by MoRTH (2010 – 2017)

Between 2010 and 2017, average annual loss per STU has increased more than 1.5 times, as fuel cost and manpower cost have increased.

India: Massive economic impact on bus transport

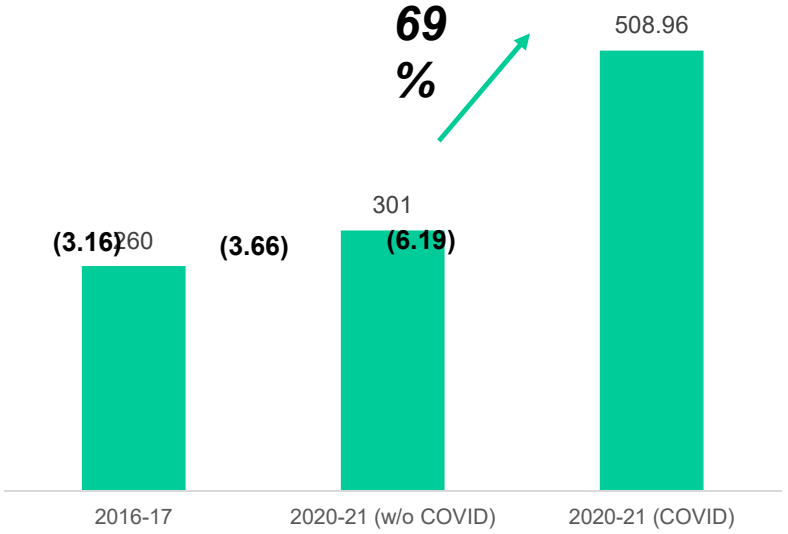
Impact of COVID-19 lock down on total cost and traffic revenue compared to Normal operations (in INR Billion)- 2020-21



** Estimated for period from March 2020 to February 2021 considering regular operations from May 2020*

Source: GIZ

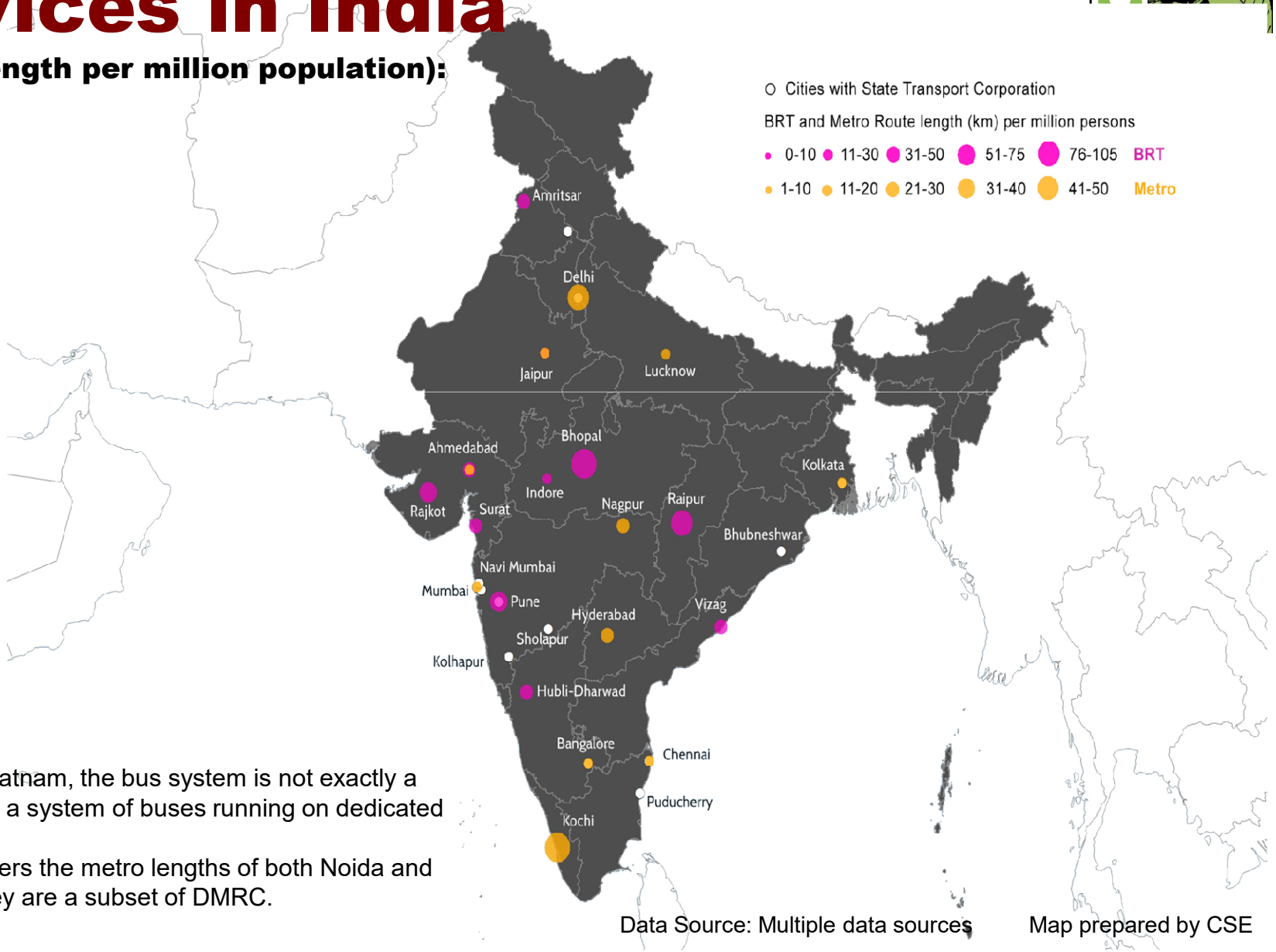
Impact of COVID-19 lock down on Annual VGF requirement* (In INR Billion) in 2020 values- 2020-21



When the cost reduced by 4%, the traffic revenue reduced by 48%. This created a 69% increase in the annual VGF requirement of bus transport agencies in India

Availability of mass transit services in India

(service length per million population):



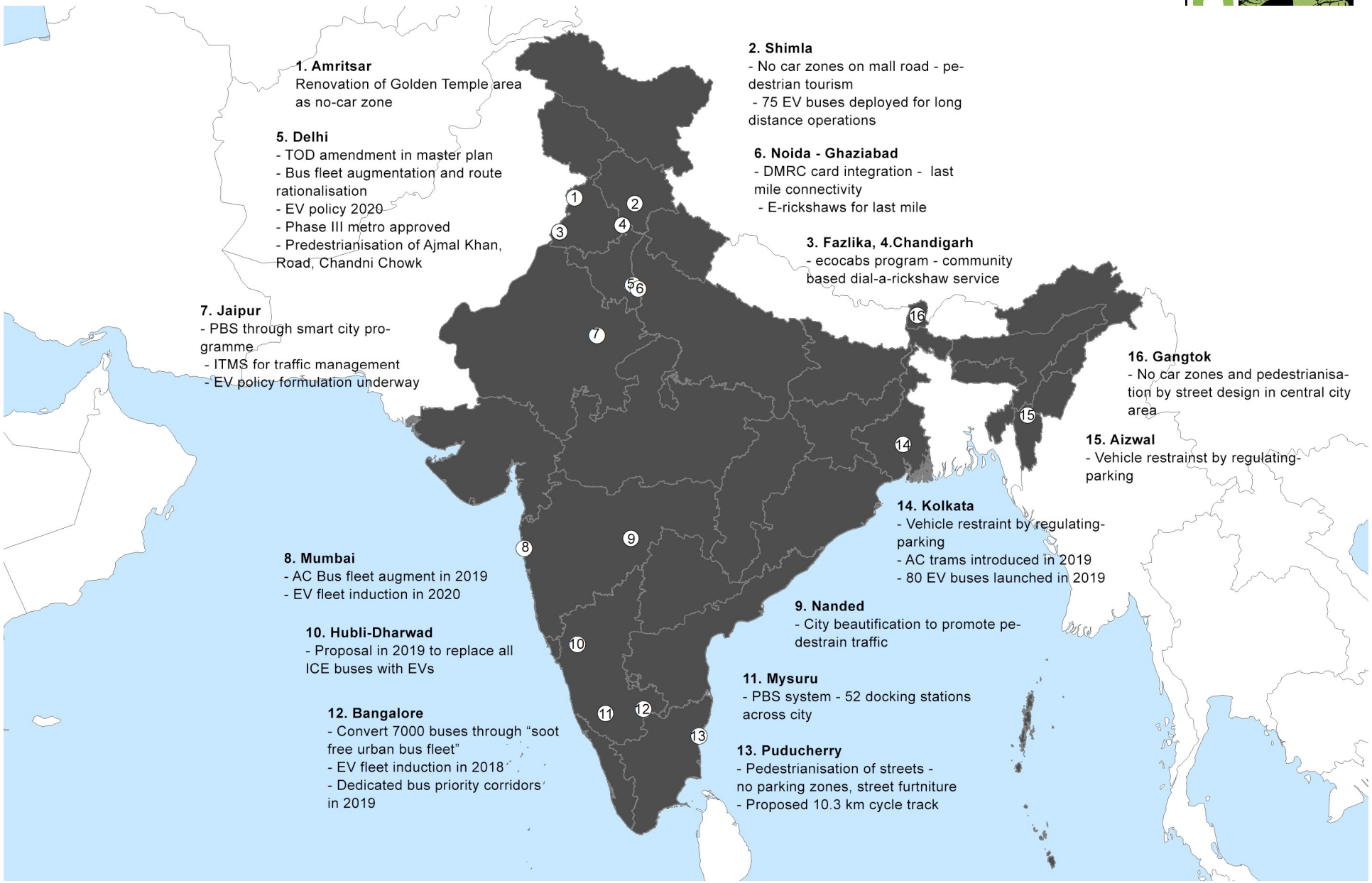
Note: Vishakhapatnam, the bus system is not exactly a BRT system, but a system of buses running on dedicated lanes.

*Delhi Metro covers the metro lengths of both Noida and Gurgaon and they are a subset of DMRC.

Data Source: Multiple data sources

Map prepared by CSE

Emerging strategies on vehicle restraint & electric vehicle programme

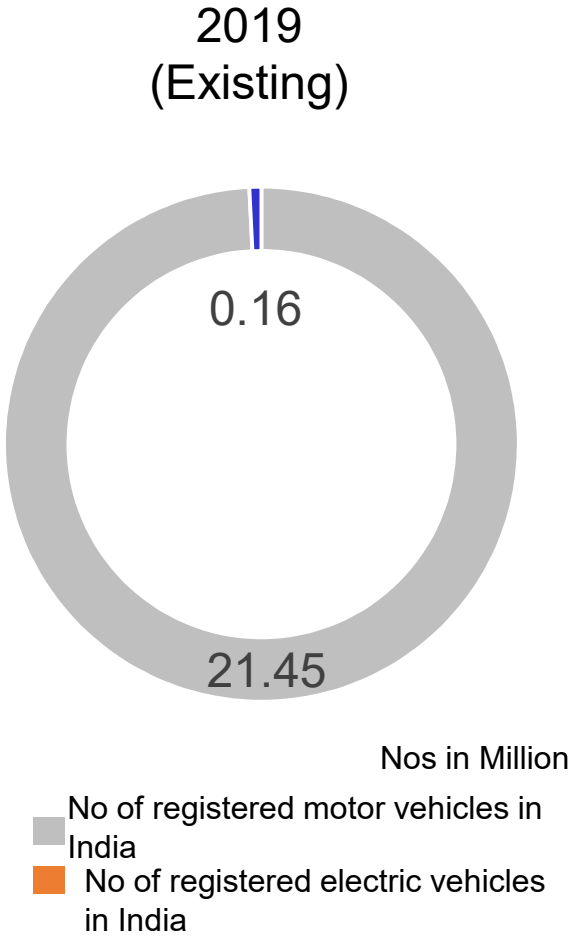


Case for green recovery:
National transport projects approved in India (in past 5 years)

Sr. no.	List of approved projects/ initiatives	Estimated project cost in Lakh Cr.
A	Regional transport improvement projects	
1	Regional railway services improvement	6.39
2	Bharatmala project	6.92
3	Sagarmala Project	3.55
4	Jal Marg Vikas	0.05
5	Solar toll plazas	0.05
6	Green Highways	0.07
7	RRTS development	0.88
	Sub total	17.91
B	Urban transport improvement projects	
1	NMT infrastructure development under AMRUT fund	0.01
2	Transport development under Smart city fund	0.51
3	Metro development (after release of metro policy 2017)	0.97
4	Electric vehicle – FAME funding	0.11
5	Improvement of Mumbai Suburban Rail Network	0.36
	Sub total	1.96
	Grand Total	19.87

High Powered Committee has recommended to invest approx. Rs 22.92 lakh crores on urban transport and associated infrastructures, over the 20 years (2011-2030) – or, more than Rs 1 lakh crore investment per year.

How will India raise ambition on electric mobility



If India has to fulfil its objective of 40% EV of all new registered vehicles (i.e. approx. 40 million) by 2030, then EV fleet has to double every alternate year…

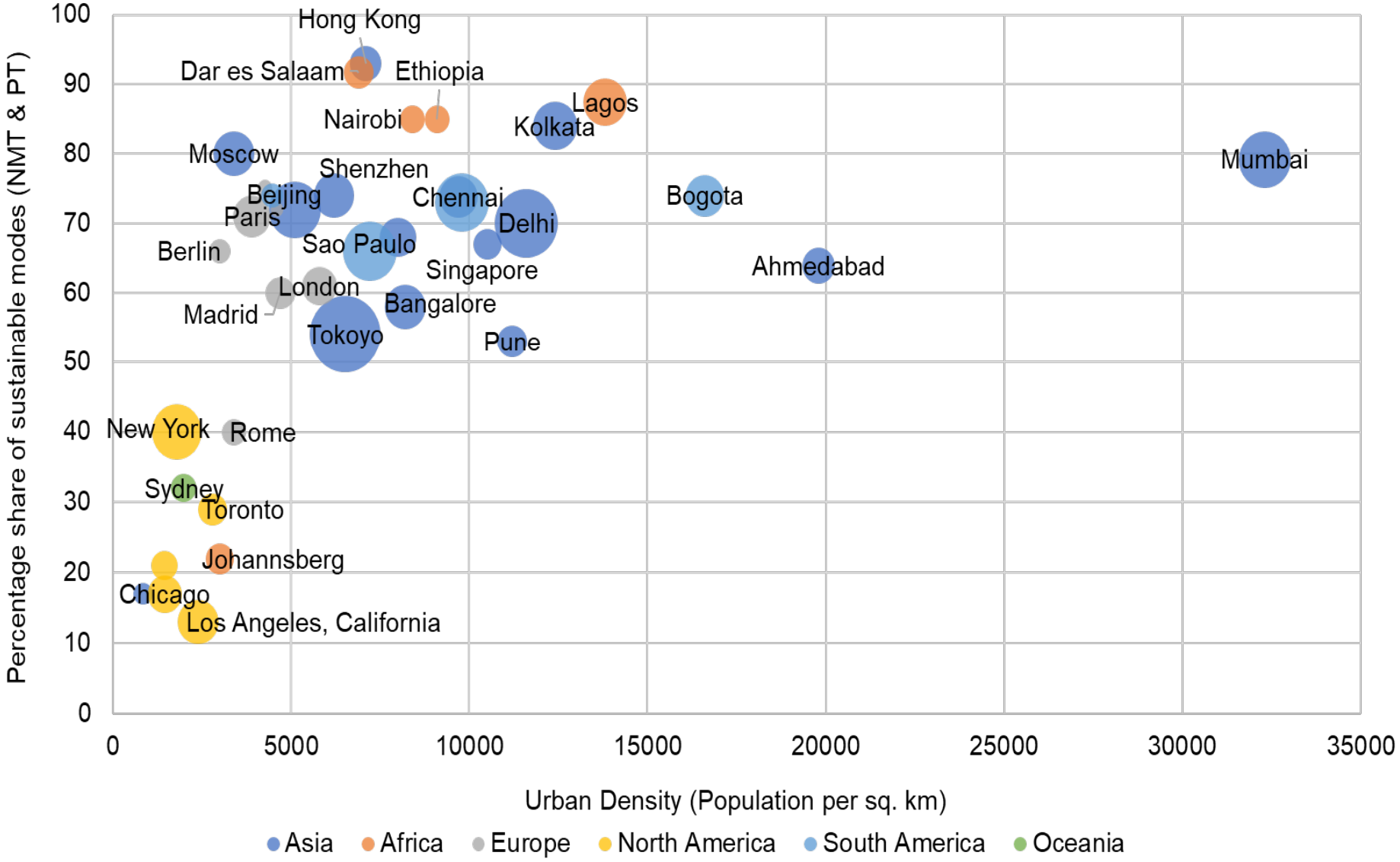
Urban form and CO2 lock-In

Advantage of developing countries

- Developing countries have better opportunity in high-density, mixed-use urban forms
- IPCC: Transport activities may plataeu at lower GDP level in non-OECD countries due to high urban densities and greater infrastructure constraint
- Transport sector inertia due to large scale infrastructure funding – needs to be addressed
- Prevent car-dependent, spatial planning – India's TOD policy, National Habitat Standards, guideline for smart cities etc
- Bridge the gap with implementation

High density compact urban form allows more sustainable travel

(Percentage share of sustainable modes vs urban density)



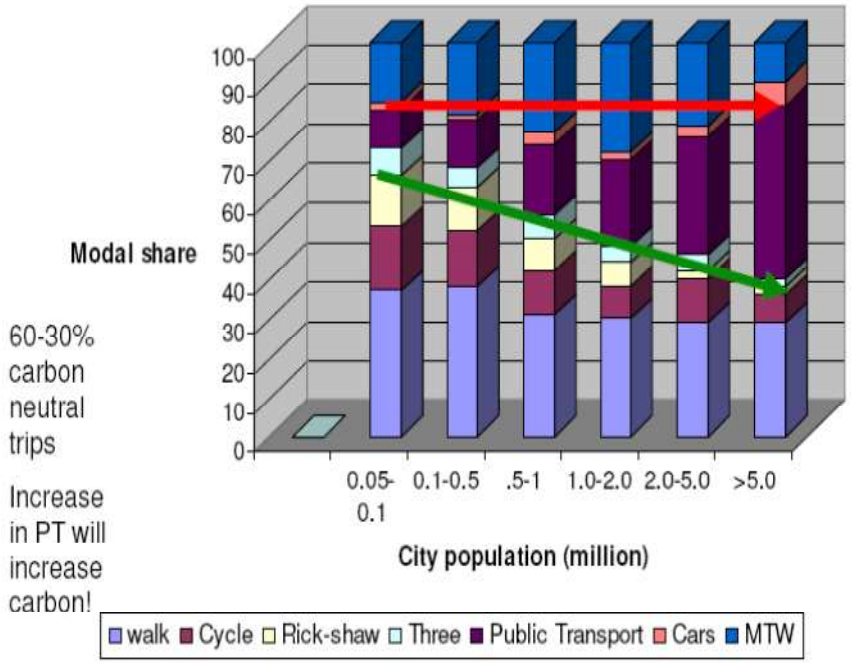
Source: Multiple sources compiled by CSE

Opportunity in Africa and India
Our inherent strength.....

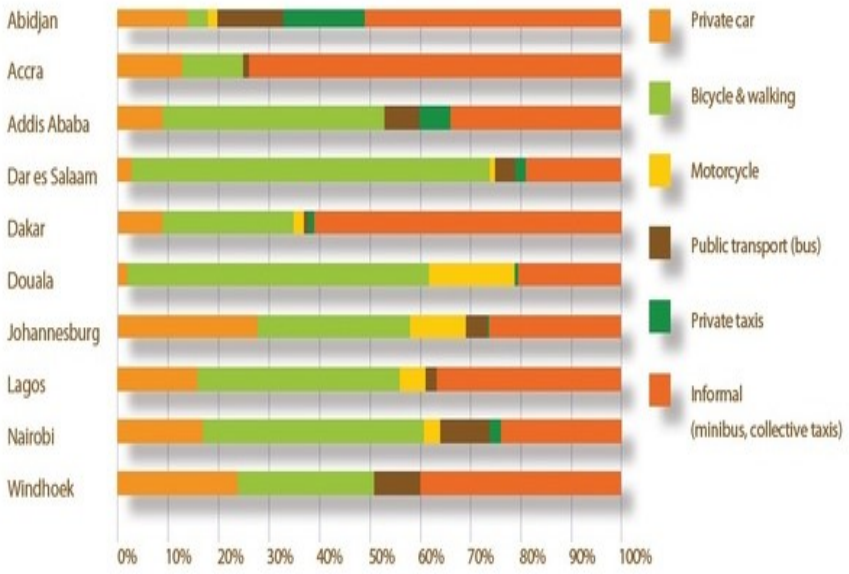
Majority walk, cycle and use public transport

Urban Mobility

PT and NMV based, MTW majority personal vehicles



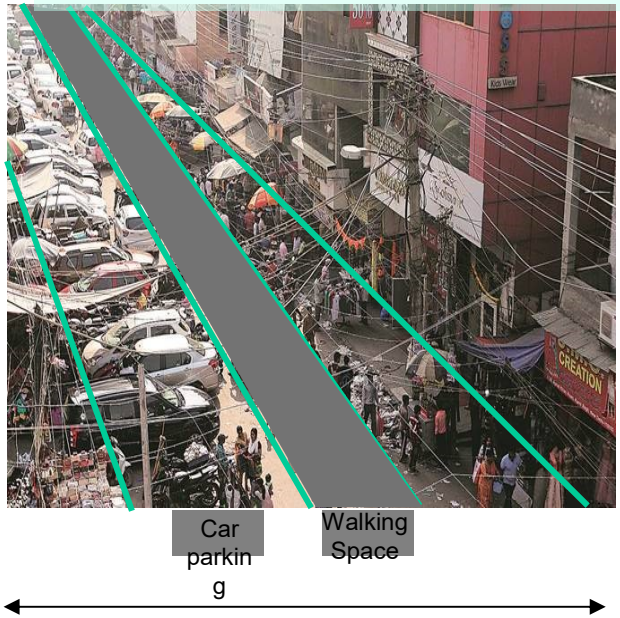
Transport modal share of the cities



Based on: International Association of Public Transport (2010) 'Major Trends and case studies'

Scale of change still small

Restructuring Ajmal Khan road



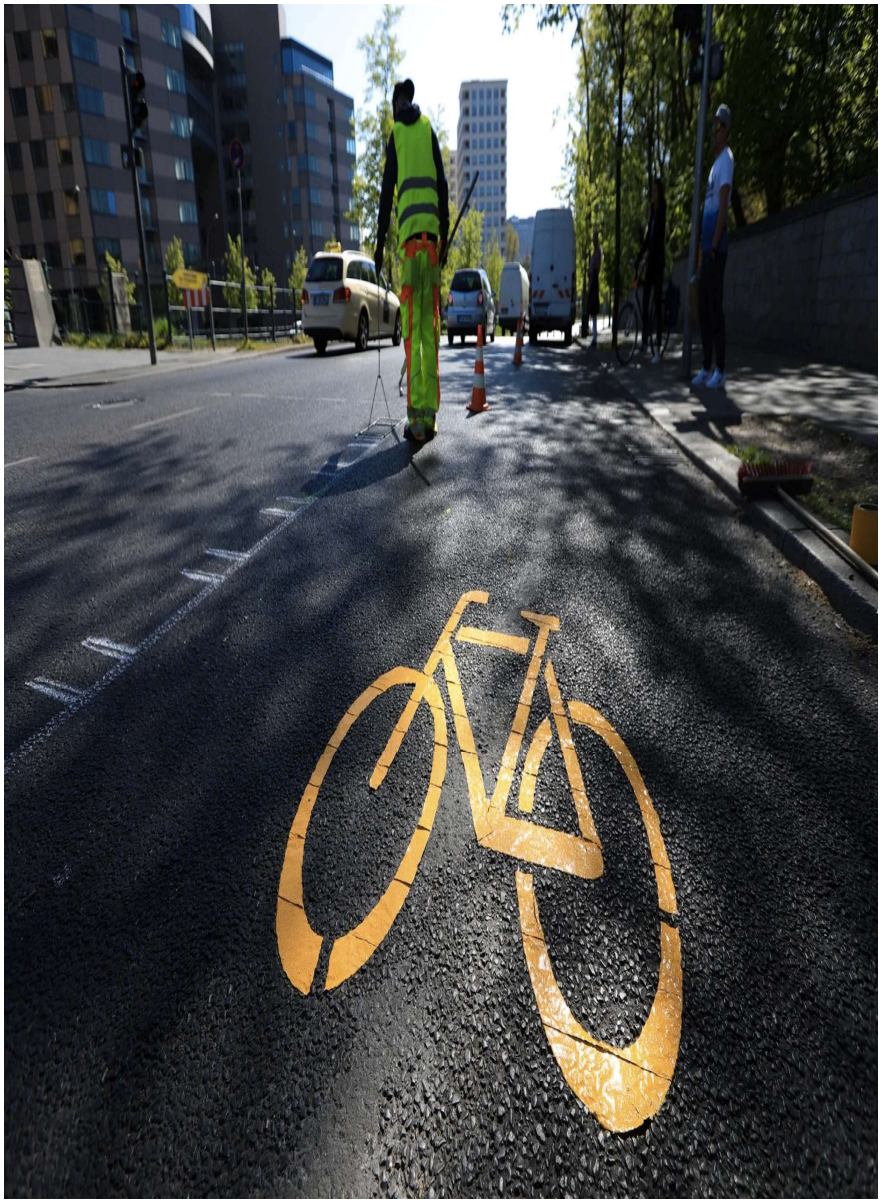
22 streets in Delhi identified for pedestrianisation

Restructuring Chandni Chowk

Footpath for the Pedestrians | Segregated Track for NMT | Cars & Cycles parked in Parking Bays

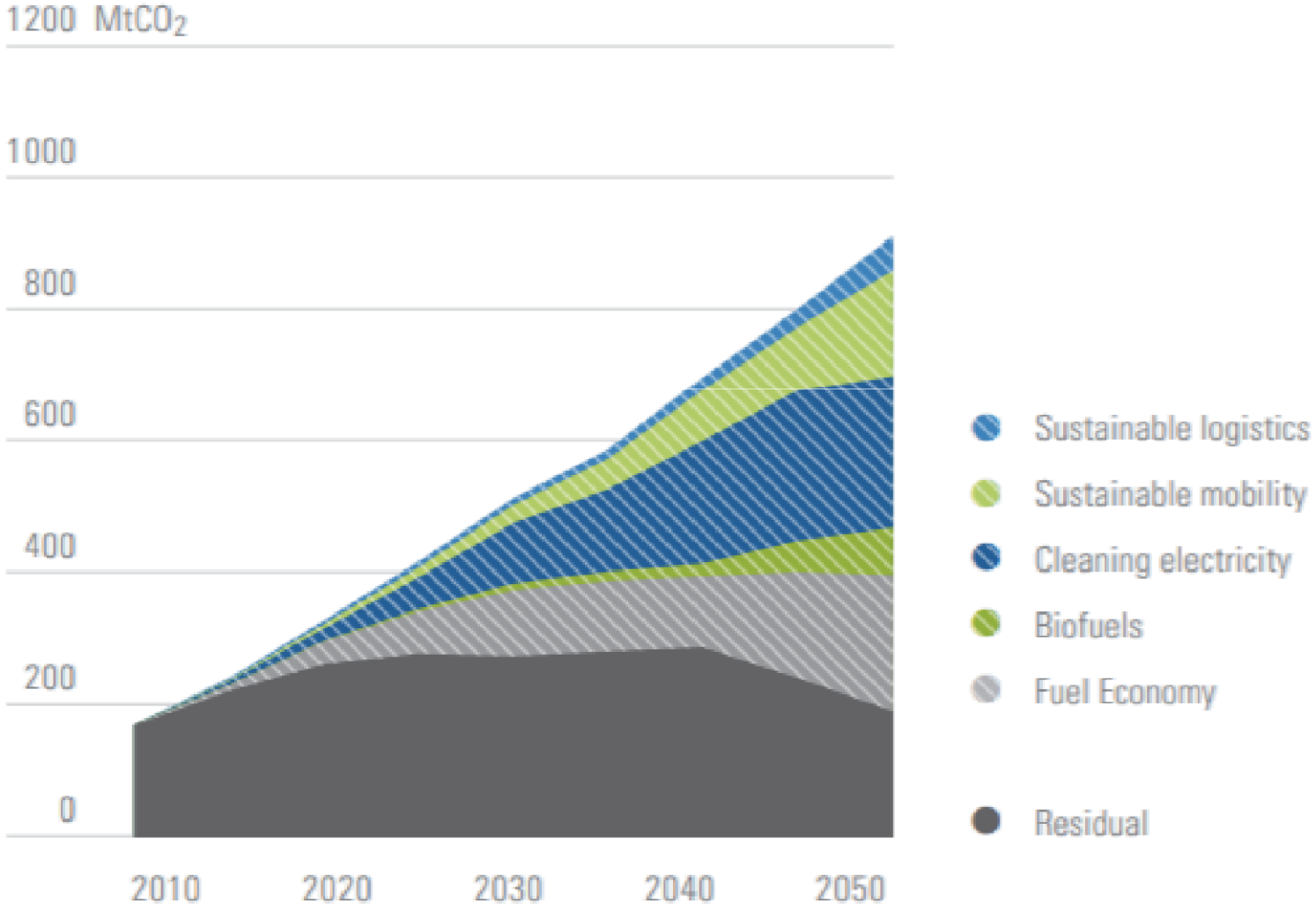
Africa doing this right: NMT policy; infrastructure despite pandemic

Europe: Rediscovering walking and cycling



Pop up bike lanes

CO2 mitigation strategies from transport in India



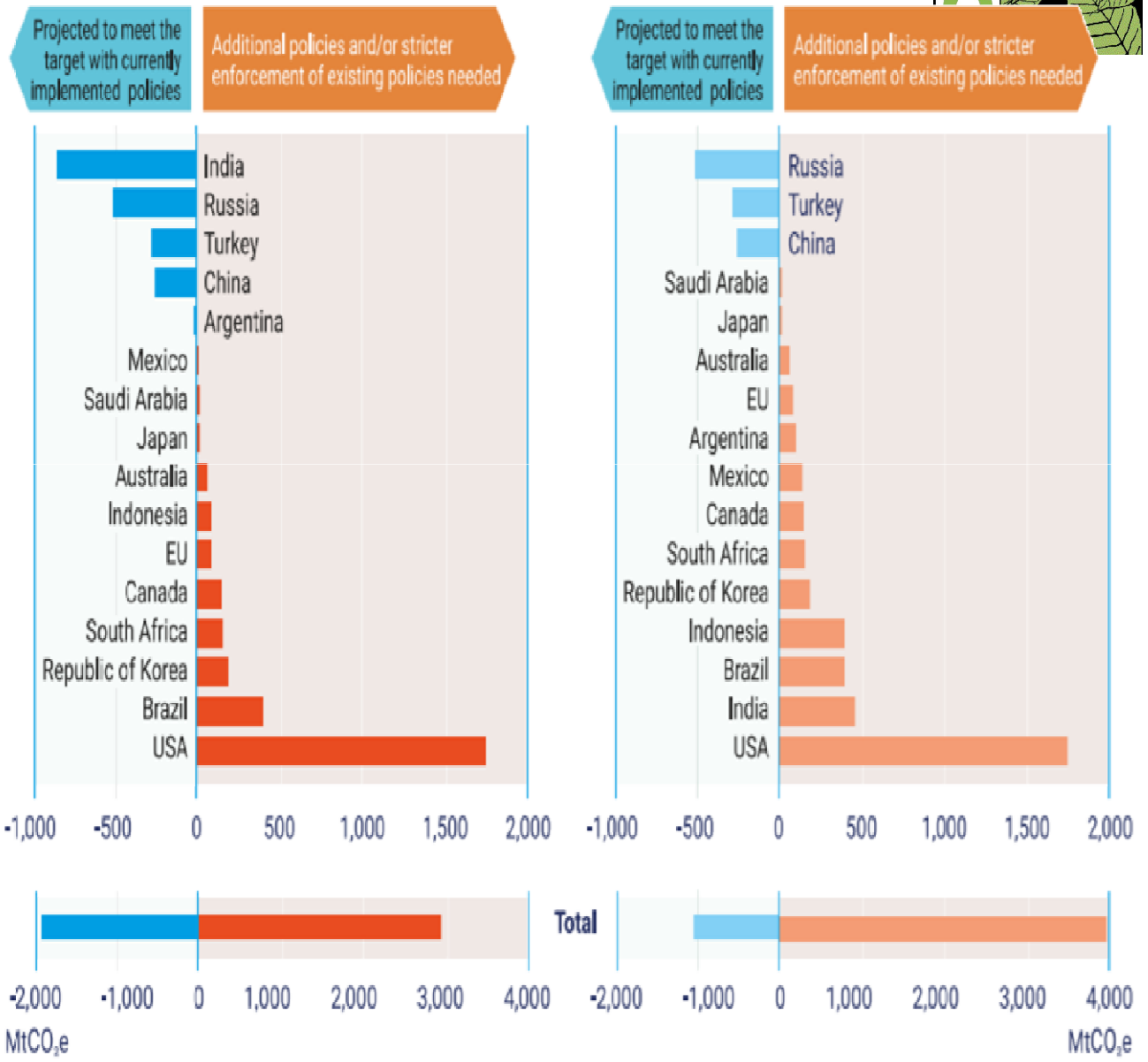
Source : Dhar & Shukla, 2015

India's NDC and transport...

UNEP Global emission gap report: India has overachieved its NDC target by more than 15%.

Report suggests to strengthen the emission targets by enhancing ambitions:

- Expand public transit system
- Develop domestic electric vehicle targets working towards 100 per cent new sales of zero-emission cars.



Towards net zero goals

Fear of rebound and retaliatory emissions post pandemic

- Emissions during lockdown reduced due to halting of travel and economic activity. Not due to structural changes

Need green recovery for:

Technology pathways:

- Support for zero-emissions technologies (electrification and go beyond internal combustion engines)

Mobility transition

- Low-carbon transport and infrastructure
- Manage travel demand to reduce frequency and distance as well as dependence on high-energy-intensity modes
- Shift travel to most efficient modes

Finally

All need to do more; Much more

- **Need ambition and effective reduction in advance countries – Mobility transition has to be part of the game**
- **India and developing countries need to build on the advantage of their baseline od high share of sustainable modes while cleaning up technologies and fuels**
- **Need real and measurable change**