

Capacity building workshop on standardized baselines in the transport sector

Regional Collaboration Centre: Bogotá, Colombia



Background

CMP.6 Parties, PPs, international industry organizations & admitted observer organizations through host country DNA: **submit** proposal for **SBs** for consideration by EB

EB79 “Baseline emissions for modal shift measures in urban passenger transport”

“Baseline emissions for modal shift measures in inter-urban cargo transport ”



Outline

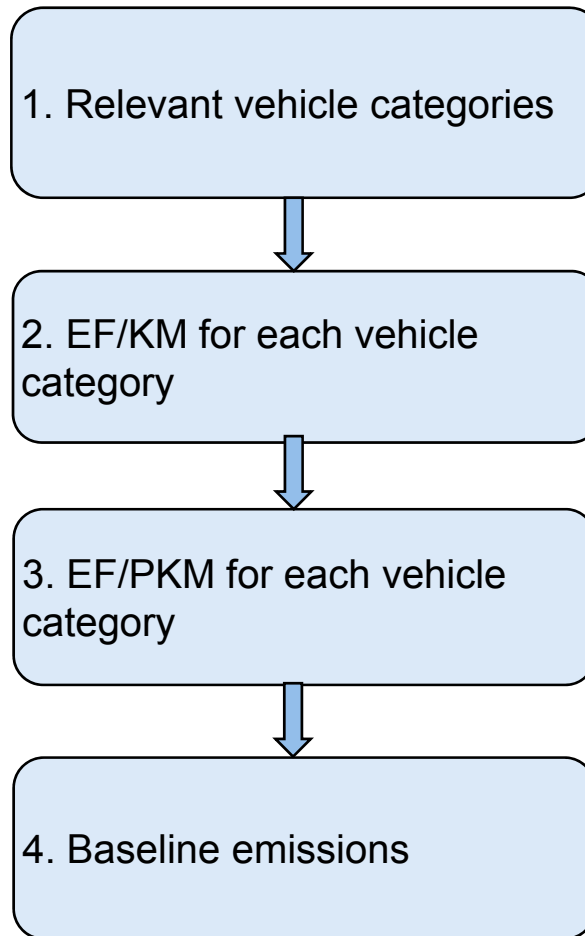
- Baseline emissions for modal shift measures in urban passenger transport
- Baseline emissions for modal shift measures in inter-urban cargo transport
 - Methodological steps
 - Calculation procedures
 - Data requirements
 - Default values



Modal shift in urban passenger transport



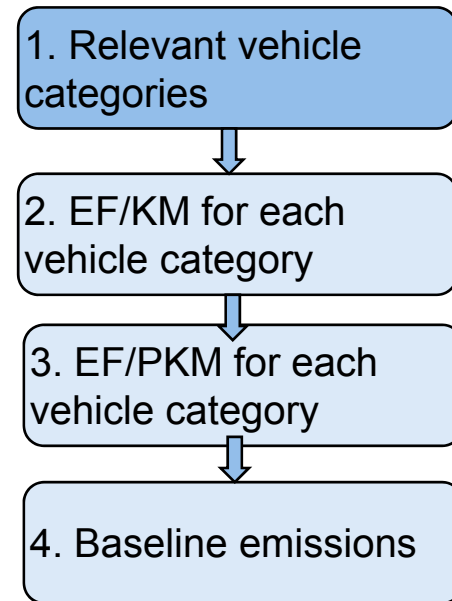
Baseline emissions for modal shift in passenger transport to urban transit



1. Determine relevant vehicle categories

- Buses
 - Conventional
 - Small
 - Medium
 - Large
 - BRTs
- Passenger cars
- Taxis
- Motorcycles
- Rail-based mass transit
 - Metro
 - Light rail transit
 - Trams

➤ Other vehicle categories such as para-transit



2. Determine EF/KM for each vehicle category

EF [gCO₂/KM]

➤ **Specific fuel consumption**

1. Locally measured data (not older 3 years)
2. National/international defaults
3. IPCC default values ~vehicle age, technology
4. Vehicle design data
5. Default values

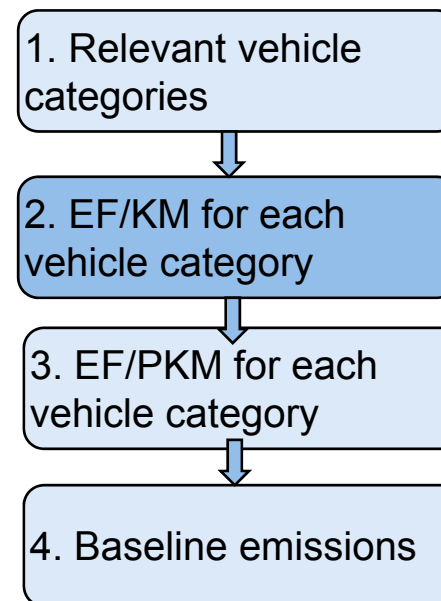
➤ **NCV**

2. National default values
3. IPCC default values

➤ **EF for fuel type** (IPCC defaults)

➤ **EF [gCO₂/KM]** default for new vehicles (cars, taxis & motorcycles)

➤ **Share** of (1) vehicle-km or (2) vehicles in category using fuel type *n*



3. Determine EF/PKM for each vehicle category

EF [gCO₂/PKM]

1. Electricity-based transport systems

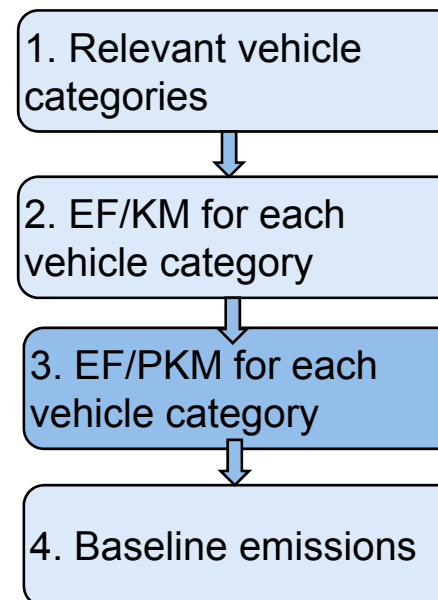
$$\frac{\text{Total electricity}}{\text{Passengers} \times \text{Distance}}$$

2. Fuel-based transport systems

$$\frac{\text{EF/KM}}{\text{Occupancy}}$$

Occupancy:

1. Municipal transit authorities
2. Average occupancy defaults
3. Survey (individual motorized transport & public transport in similar cities)



	World	South Asia	Unit
Car	2		Person (including the driver)
Taxi	1.1		Person (excluding the driver)
Motorcycle	1.5		Person (including the driver)
Bus	40%	80%	Total capacity

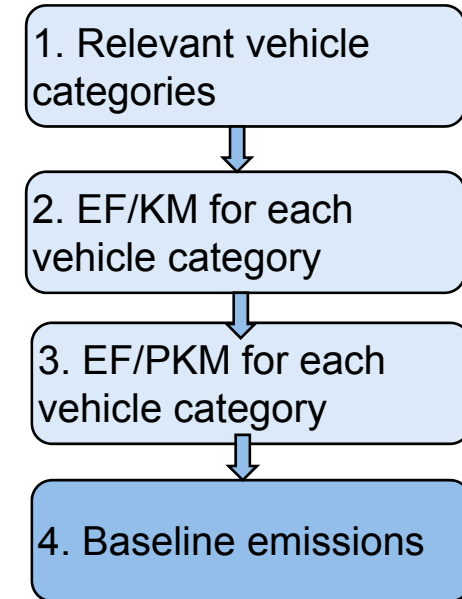
1. Determine EF/PKM for each vehicle category

Baseline emissions:

- EF [gCO₂/PKM]

➤ Survey of project system

- Total number of passengers (annually)
- Entry/exit station => Average trip distance
- Vehicle category used before



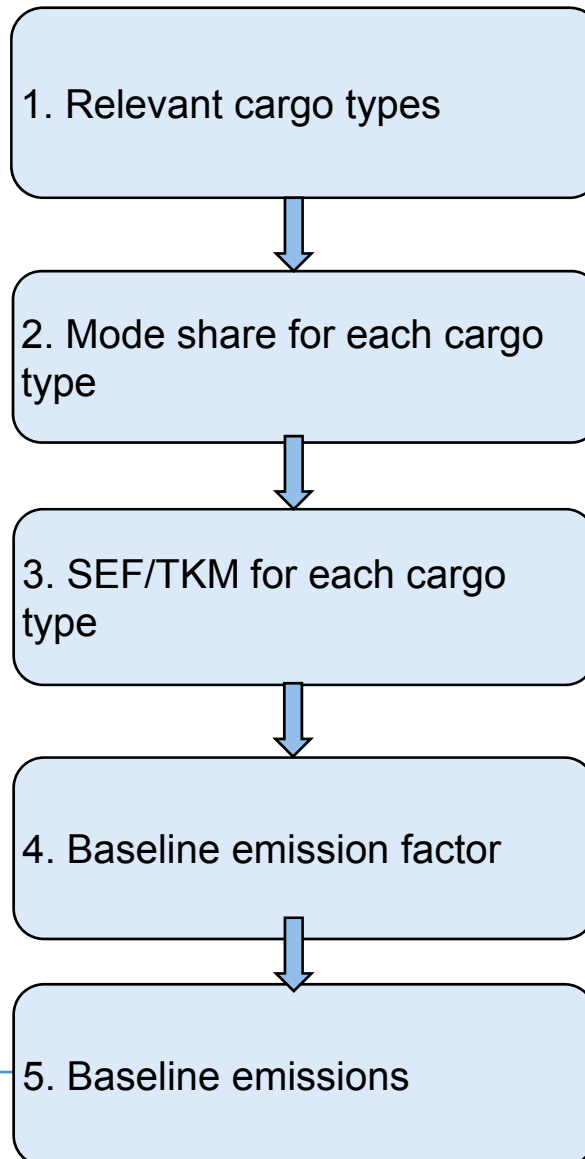
Year
1 & 4



Modal shift in inter-urban cargo transport



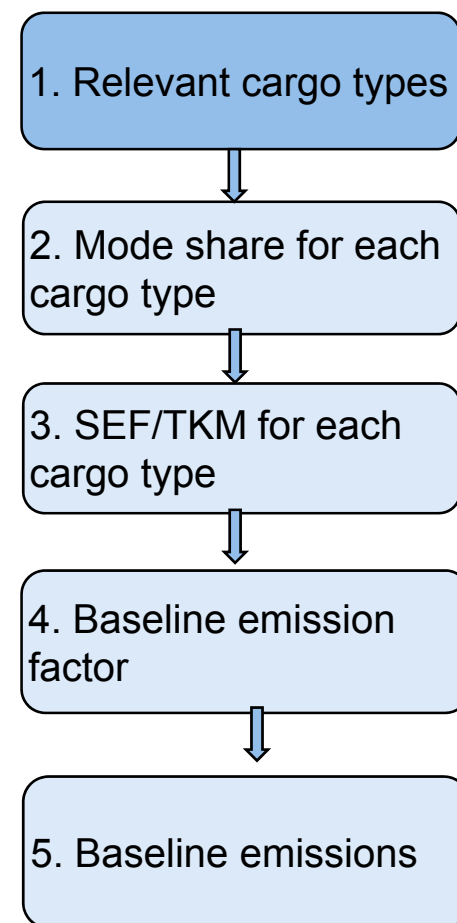
Modal shift in inter-urban cargo transport



1. Determine relevant cargo types

- **Level of aggregation:** region/province/country
~availability data, infrastructure & modes of transport

Agricultural products and live animals
Beverage
Groceries
Perishable and semi-perishable foodstuff and canned food
Other food products and fodder
Solid mineral fuels and petroleum products
Ores and metal waste
Metal products
Mineral products
Other crude and manufactured minerals and building materials
Fertilizers
Chemicals
Transport equipment
Machinery and metal products
Glass and ceramic and porcelain products

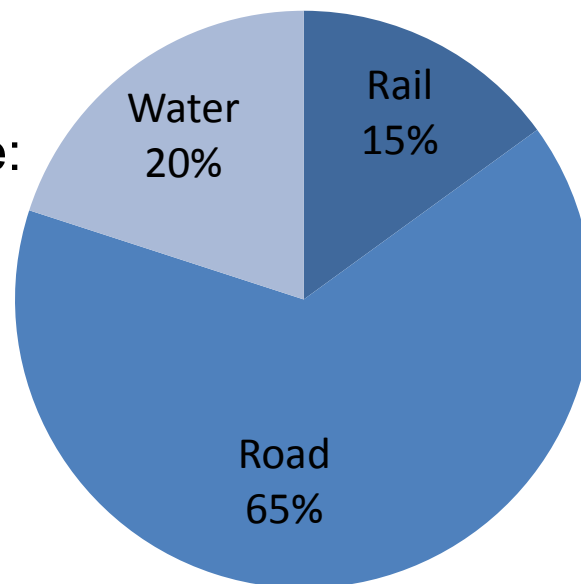


2. Mode share for each cargo type

Mode share [%] of TKM for relevant cargo types:

$$\frac{\text{Cargo type [TKM] by mode K}}{\text{Total TKM of cargo type}}$$

For each cargo type:



1. Relevant cargo types

2. Mode share for each cargo type

3. SEF/TKM for each cargo type

4. Baseline emission factor

5. Baseline emissions

3. Average specific EF per TKM per mode

➤ Rail & domestic water transport

1. SEF/each cargo type per mode (if data available)
2. SEF/ all cargo types per mode
3. Default values
 - Rail: electric & diesel ~ low density & high density
 - Domestic water: bulk & containers

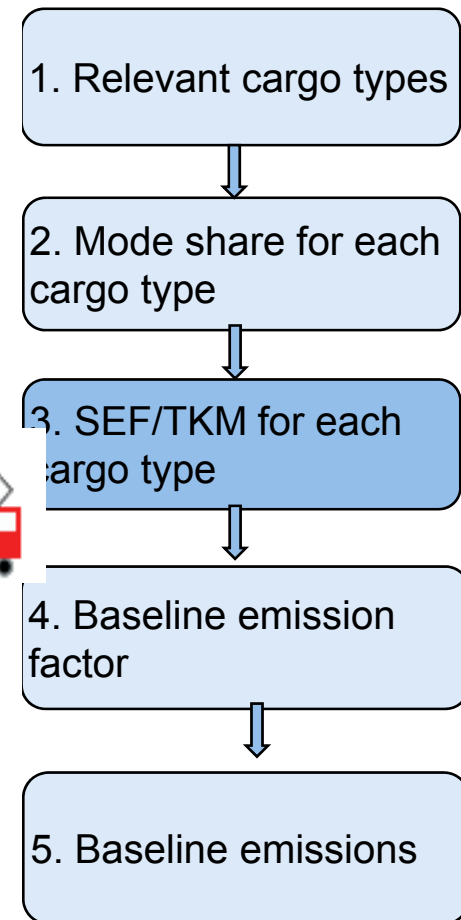


➤ Road transport

1. Default value ~ cargo type
2. Historic data or survey
 - FC, NCV, EF, cargo & distance

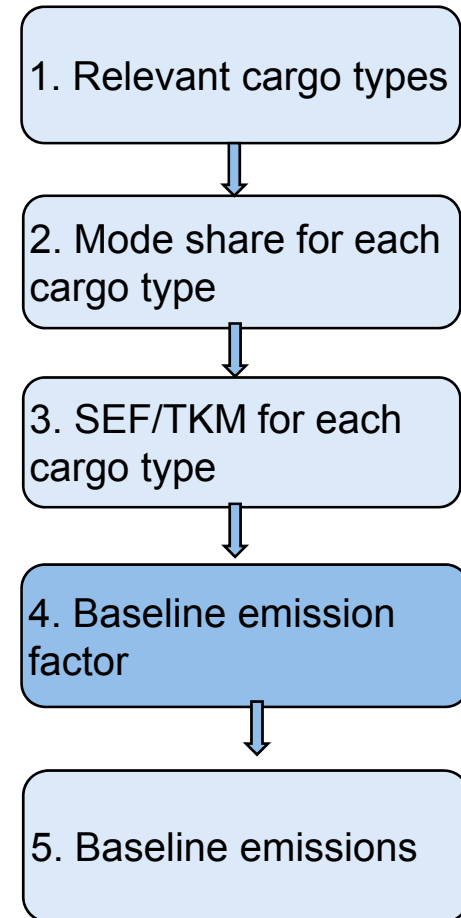
➤ Pipeline

- FC, NCV, EF, cargo
- Electricity, EF, cargo



4. Baseline EF for each cargo type

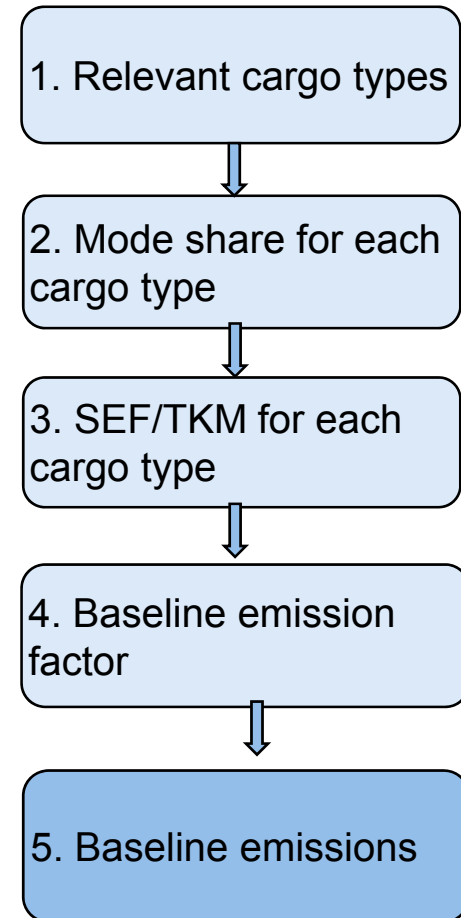
- Mode share [%] for each cargo type
- Specific EF/TKM for each cargo type per mode



5. Baseline emissions

Project data:

- Baseline EF per cargo type transported in project
- Amount of cargo transported by project (TKM)



References

- Guidelines for quality assurance and quality control of data used in the establishment of standardized baselines;
- Procedure for development, revision, clarification and update of standardized baselines;
- Standard for data coverage and validity of standardized baselines;
- Tool to calculate baseline, project and/or leakage emissions from electricity consumption



Conclusion

Public transit

- Modal shift to public transit: largest mitigation potential in passenger transportation
- Collecting data for baseline setting – high transaction costs
- Options to use default values for most of parameters: reduce transaction costs for project developers

Rail & water-borne transport

- Modal shift to rail & water-borne transport: largest mitigation potential in cargo transportation
- Methodological approaches for baseline setting:
 - Large & small countries
 - Baseline for region, province & country
 - Baseline EF: individual cargo type or all relevant cargo types
 - High & low data availability
 - Baseline EF: each cargo type & mode, mode (for all cargo types) or default value



Thank you for your attention!



Supplementary slides



Rationale for target measures

Measures in transport:

Trip reduction & avoidance, trip efficiency

Modal shift

Fuel switch

Efficiency/performance improvement

CDM



Rationale for target measures: Passenger transport

Cities (GEA 2012, IEA 2008, IPCC forthcoming):

- occupy only around 3% of the Earth's land surface,
- house a half of global population,
- consume ~ 75% of global resources
- responsible of over 70% of total global GHG emissions
- In a few decades, over 80% of global GHG emissions

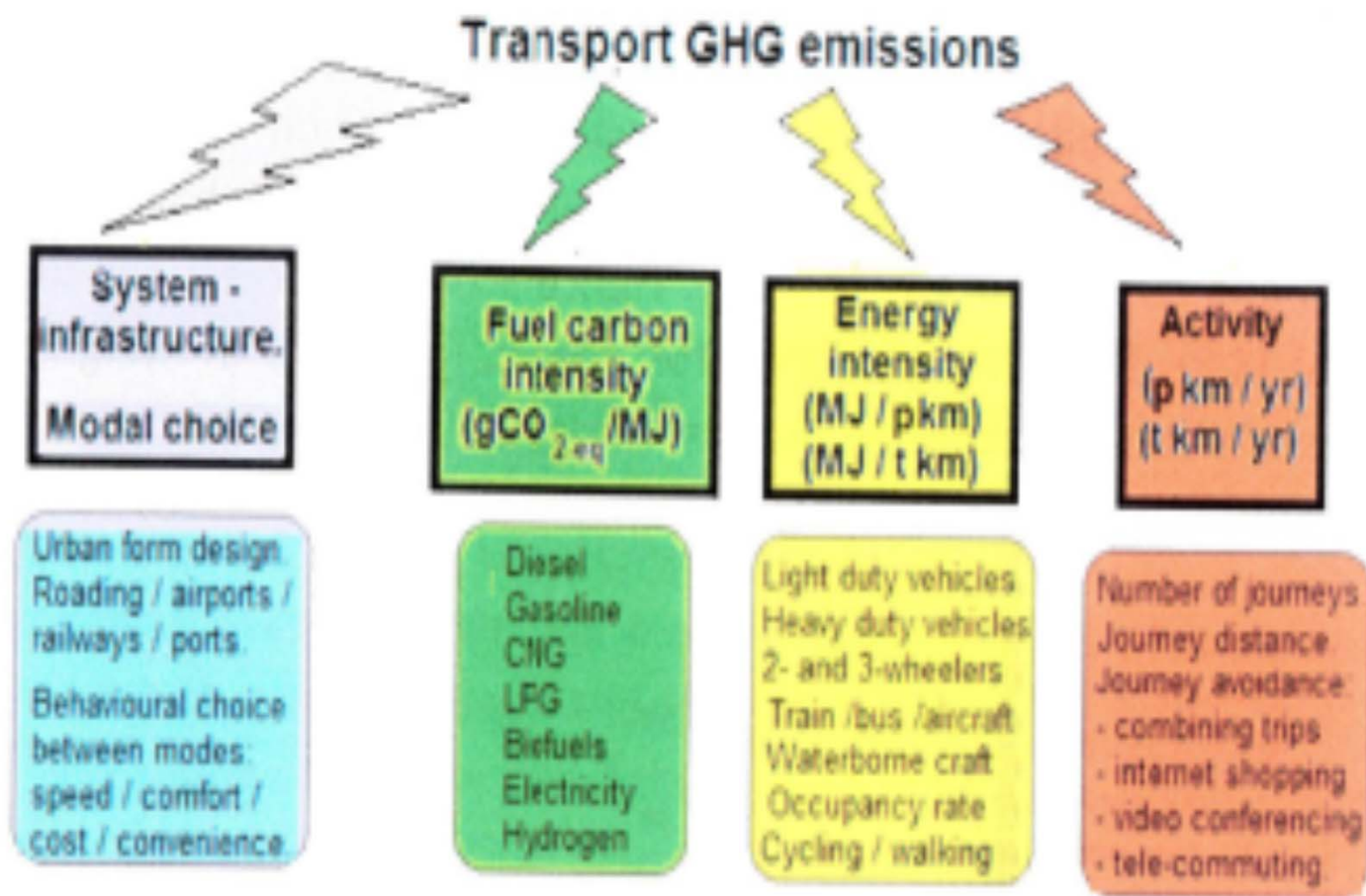
Major emission sources in cities:

- Transport
- Buildings
- Industry

Measures in transport:

- Trip reduction & avoidance – urban planning & logistics- outside of CDM
- Modal shift to public transit

Transport GHG emissions



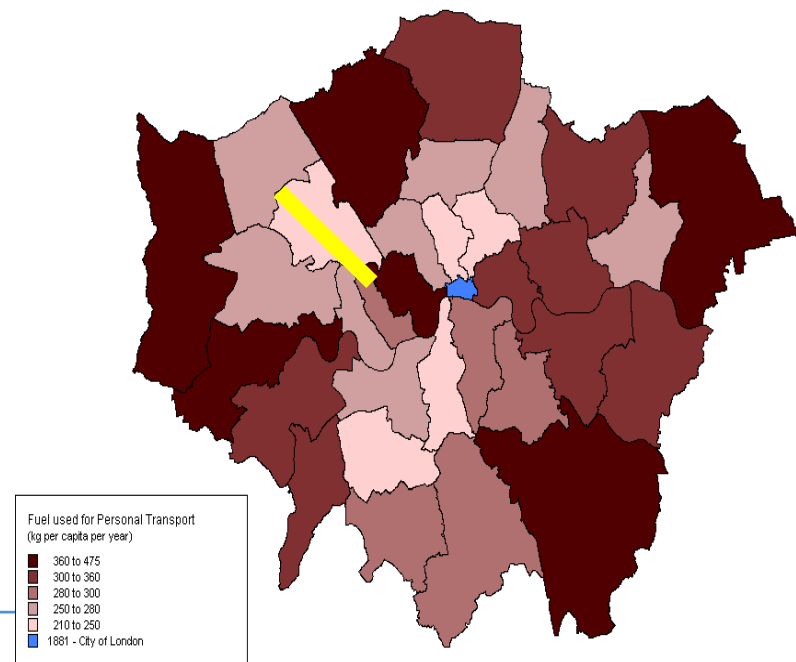
$$\text{Total annual GHG emissions} = \sum_{\text{Modal shares}} \left(\sum_{\text{Fuels}} (\text{Fuel C intensity} * \text{Energy intensity} * \text{Activity}) \right)$$

CDM: Transaction costs vis-a-vis precision in emission estimations

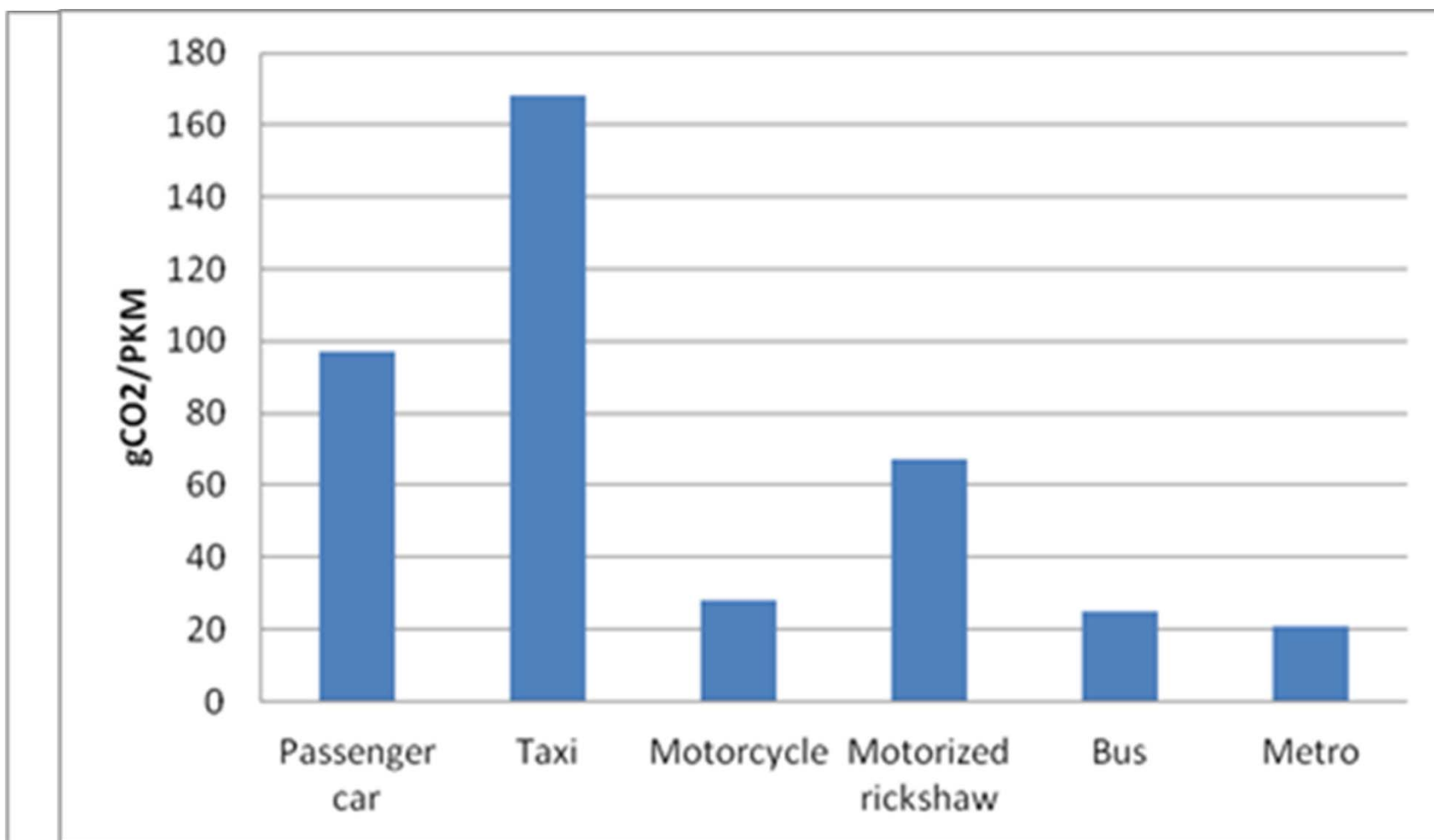
CDM methodologies:

➤ Appropriate level of aggregation to establish baseline for CDM project:
project boundaries:

- Boundaries for data collection => appropriate EF
- Transaction costs => only relevant data is collected



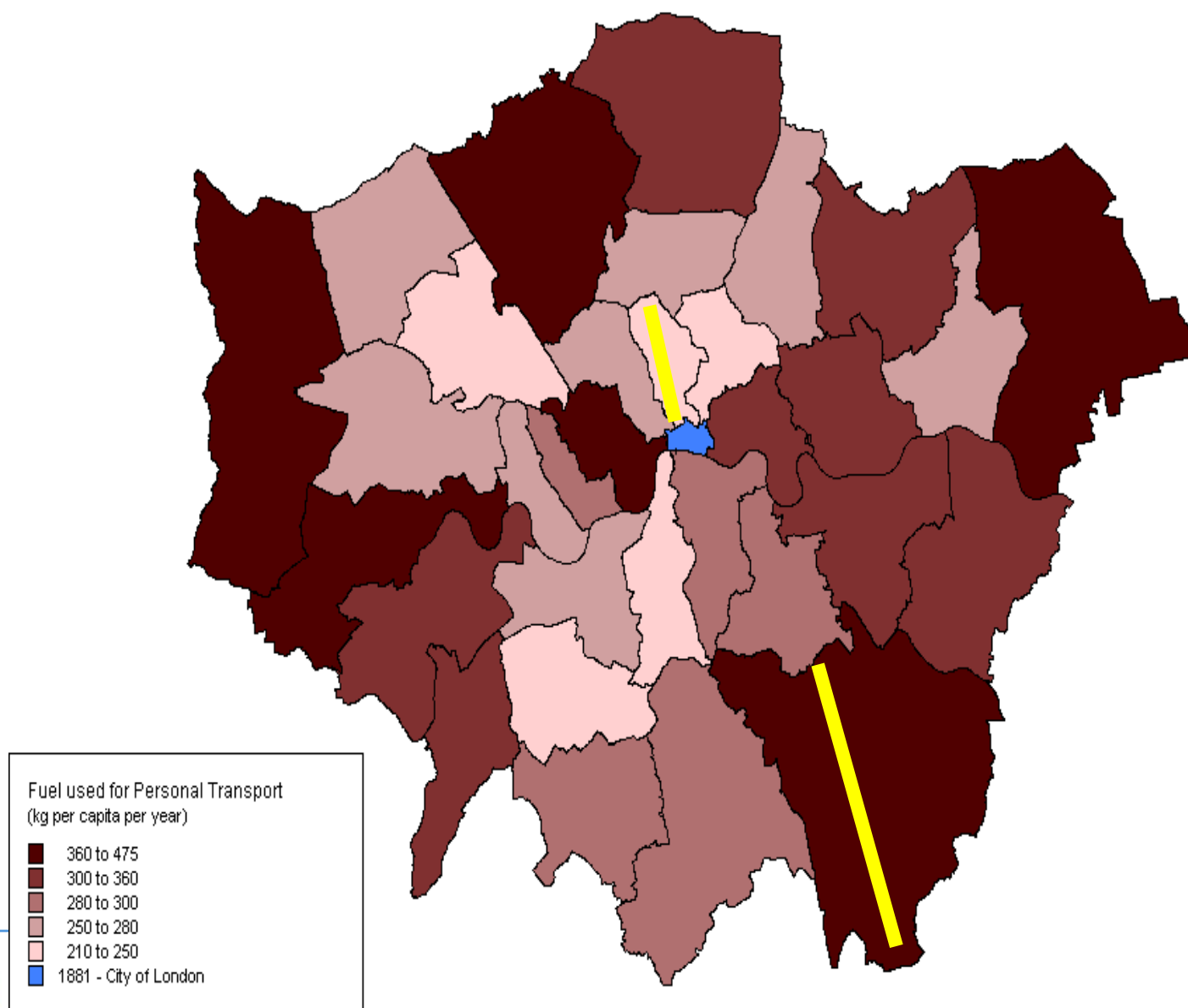
Emissions per mode of transit



Source: PDD metro in Delhi



Link to project boundary



**Baseline emissions for modal shift measures in
urban passenger transport**



- High population & employment densities that are co-located
- Compact urban form
- Mixed land use
 - City scale: mix of offices, shops and shopping centers, businesses, residential areas => reduction in travel distances
 - Building block scale: small dimensions of individual buildings, narrow streets => walkable neighborhoods + use of non-motorized transport

Modal shift in passenger transport to urban transit

1. Determine relevant vehicle categories

- Buses (conventional & BRTs)
- Passenger cars
- Taxis
- Motorcycles
- Rail-based mass transit (metro, light rail transit, trams)

2. Determine EF/KM for each vehicle category

- SFC, NCV, EF for fuel

3. Determine EF/PKM

- Occupancy of vehicle categories

4. Baseline emissions

- EF/PKM
- Passengers shifted from each category
- Total # of passengers



Modal shift in passenger transport to urban transit

- Local vehicles
- Local mode shares

Defaults:

- SFC
- NCV
- EF for fuel type
- Occupancy

Project data:

- Number of passengers shifted from each mode

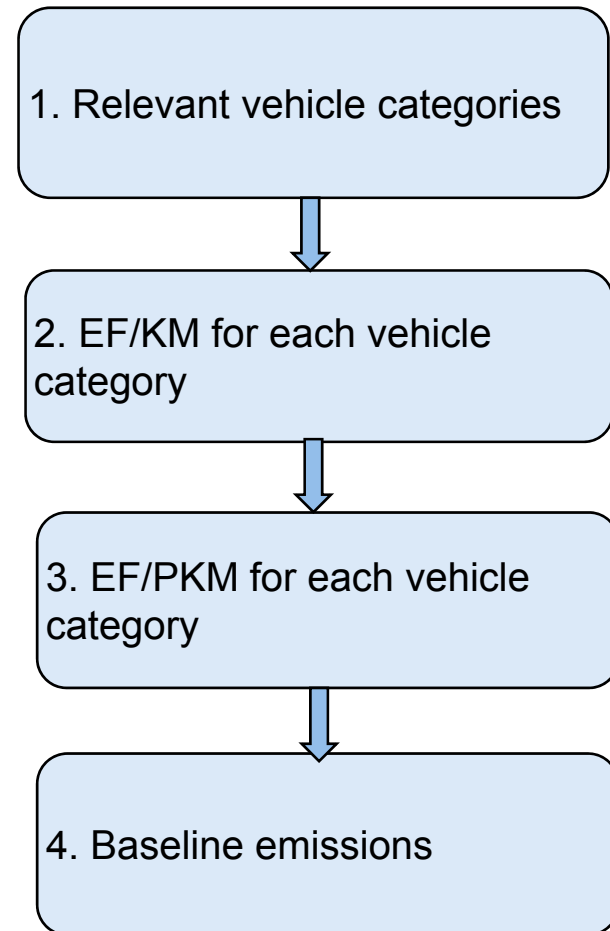


Table 1: Performance and costs of various MRT systems.

World Bank, Cities on the Move, Urban Transport Strategy Review (Oct. 2001)

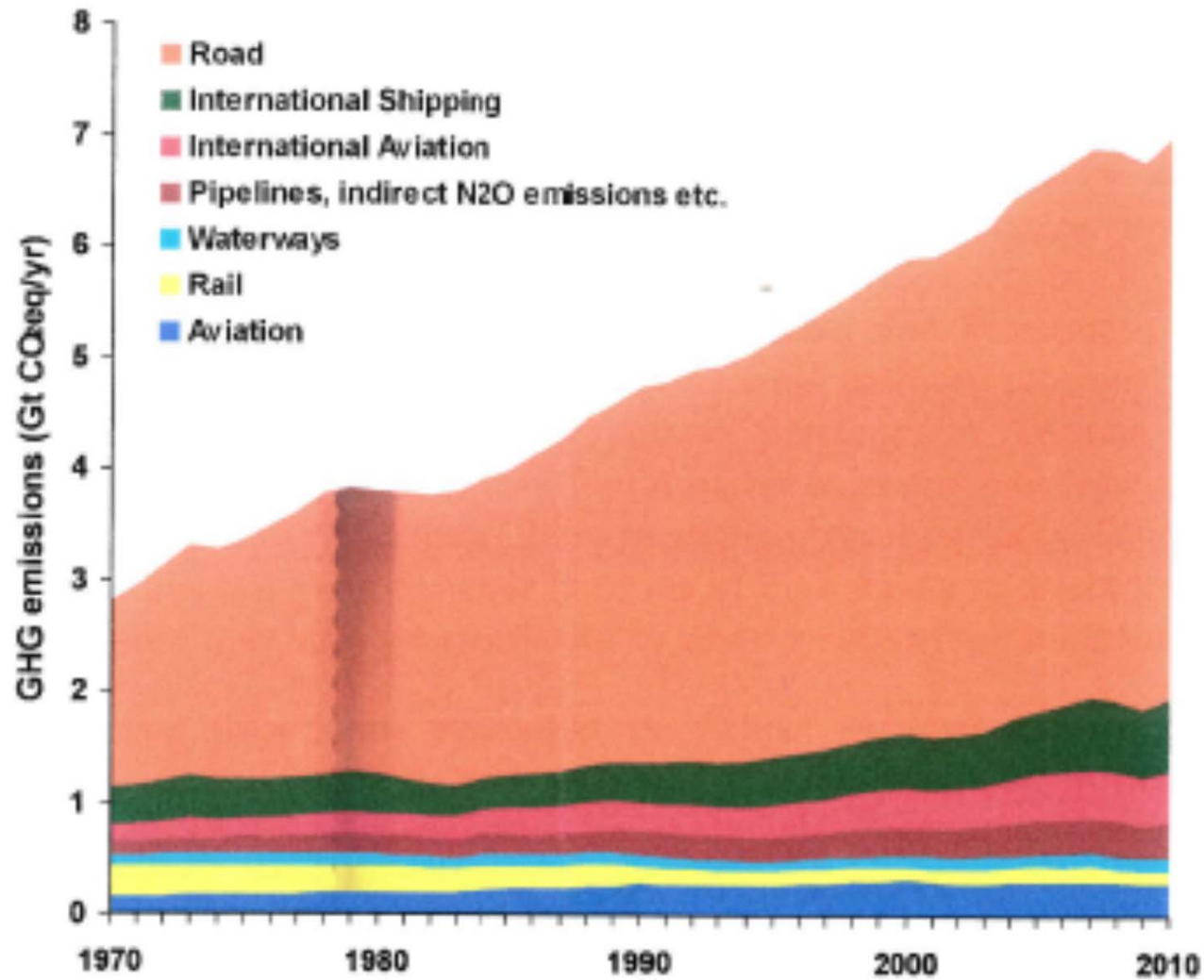
EXAMPLE	CARACAS (Line 4)	BANGKOK (BTS)	MÉXICO (Line B)	KUALA LUMPUR (Putra)	TUNIS (SMLT)	RECIFE (Linha sul)	QUITO Busway	BOGOTÁ (TransMilenio, Phase 1)	PORTO ALEGRE Busways
Category	Rail metro	Rail metro	Rail metro	Light rail	Light rail	Suburban rail conversion	Busway	Busway	Busway
Technology	Electric, steel rail	Electric, steel rail	Electric, rubber tyre	Electric, Driverless	Electric, steel rail	Electric, steel rail	AC Electric duo-trolleybus	Articulated diesel bus	Diesel buses
Length (km)	12.3	23.1	23.7	29	29.7 km	14.3	11.2 (+ext 5.0)	41	25
Vertical segregation	100% tunnel	100% elevated	20% elevated 55% at grade 25% tunnel	100% elevated	At grade	95% at grade 5% elevated	At grade, Partial signal priority	At grade, Mainly segregated	At grade, No signal priority
Stop spacing (kms)	1.5	1.0	1.1	1.3	0.9	1.2	0.4	0.7	0.4
Capital cost, (\$m) of which:	1,110	1,700	970	1,450	435	166	110.3	213 (inf only)	25
Infrastructure/TA/ Equipment (\$m)	833	670	560	n.a.	268	149	20.0	322	25
Vehicles (\$m)	277	1,030	410	n.a.	167	18	80 (113 vehs.)	Not included (private operation)	Not included (private operation)
Capital cost/route km (\$m)	90.25	73.59	40.92	50.0	13.3	11.6	10.3	5.2	1.0
Initial (ultimate) vehicles or trains / hour / direction	20 (30)	20 (30)	13 (26)	30	n.a.	8	40 (convoy operation planned)	160	n.a.
Initial maximum pass capacity	21,600	25,000	19,500	10,000	12,000	9,600	9,000		20,000
Maximum pass. carrying capacity	32,400	50,000	39,300	30,000	12,000	36,000	15,000	35,000	20,000
Ave operating speed (kph)	50	45	45	50	13/20	39	20	20+ (stopping) 30+ (express)	20
Rev/operating cost ratio	n.a.	100	20	>100	115% in 1998	n.a.	100	100	100
Ownership	Public	Private (BOT)	Public	Private (BOT)	Public	Public	Public (BOT) under consideration	Public infrastructure, private vehicles	Public infrastructure, private vehicles
Year completed	2004	1999	2000	1998	1998	2002	1995 (ext 2000)	2000 (1998 prices)	Mostly 1990s

Source: James Urban Transport System; BB&J Consult, 2000; J. Rebelo, and G. Menckhoff.

**Baseline emissions for modal shift measures in
inter-urban cargo transport**



Global transport emissions



Source: IPCC Forthcoming.

Emissions per mode of transit

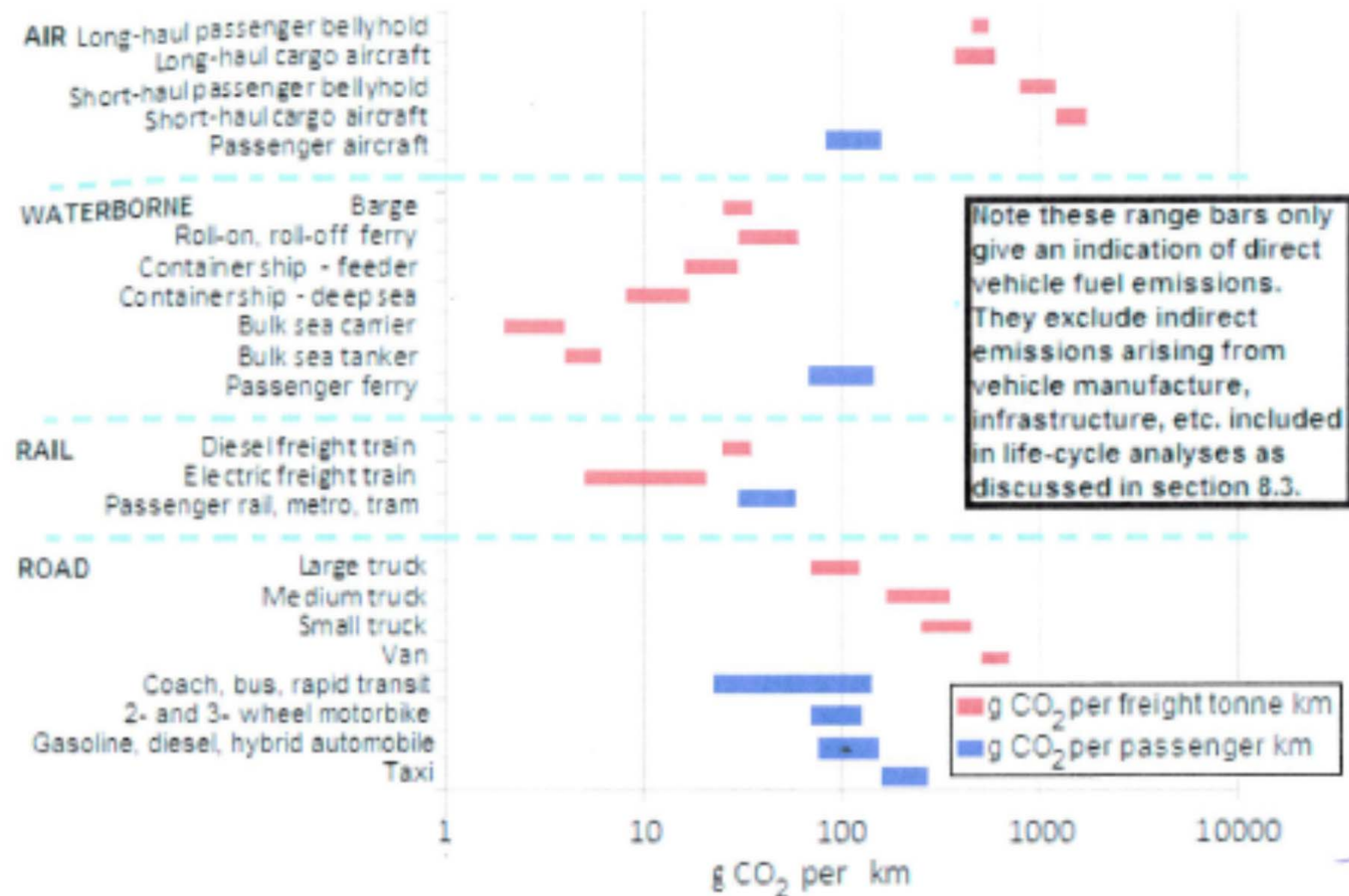
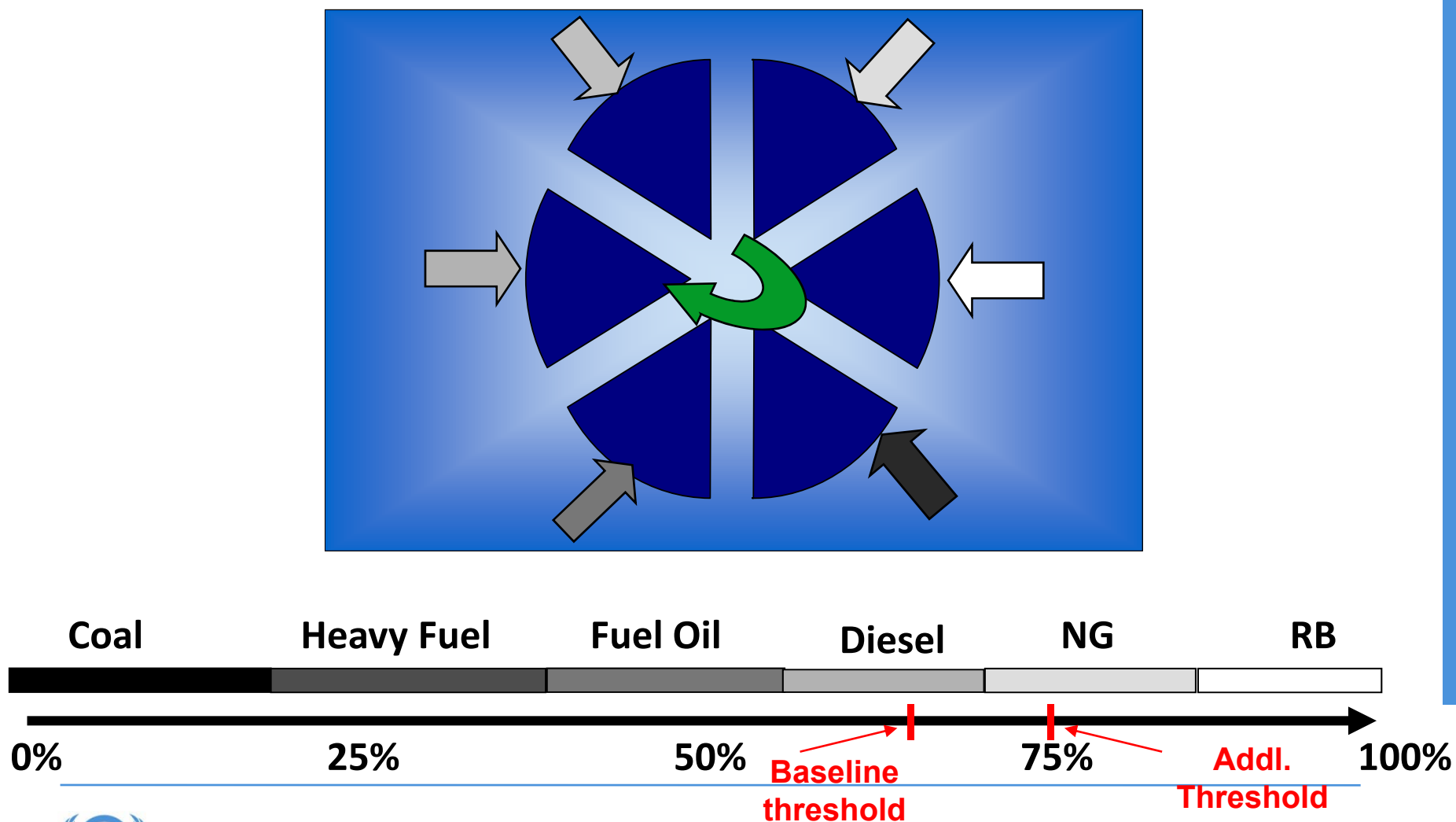


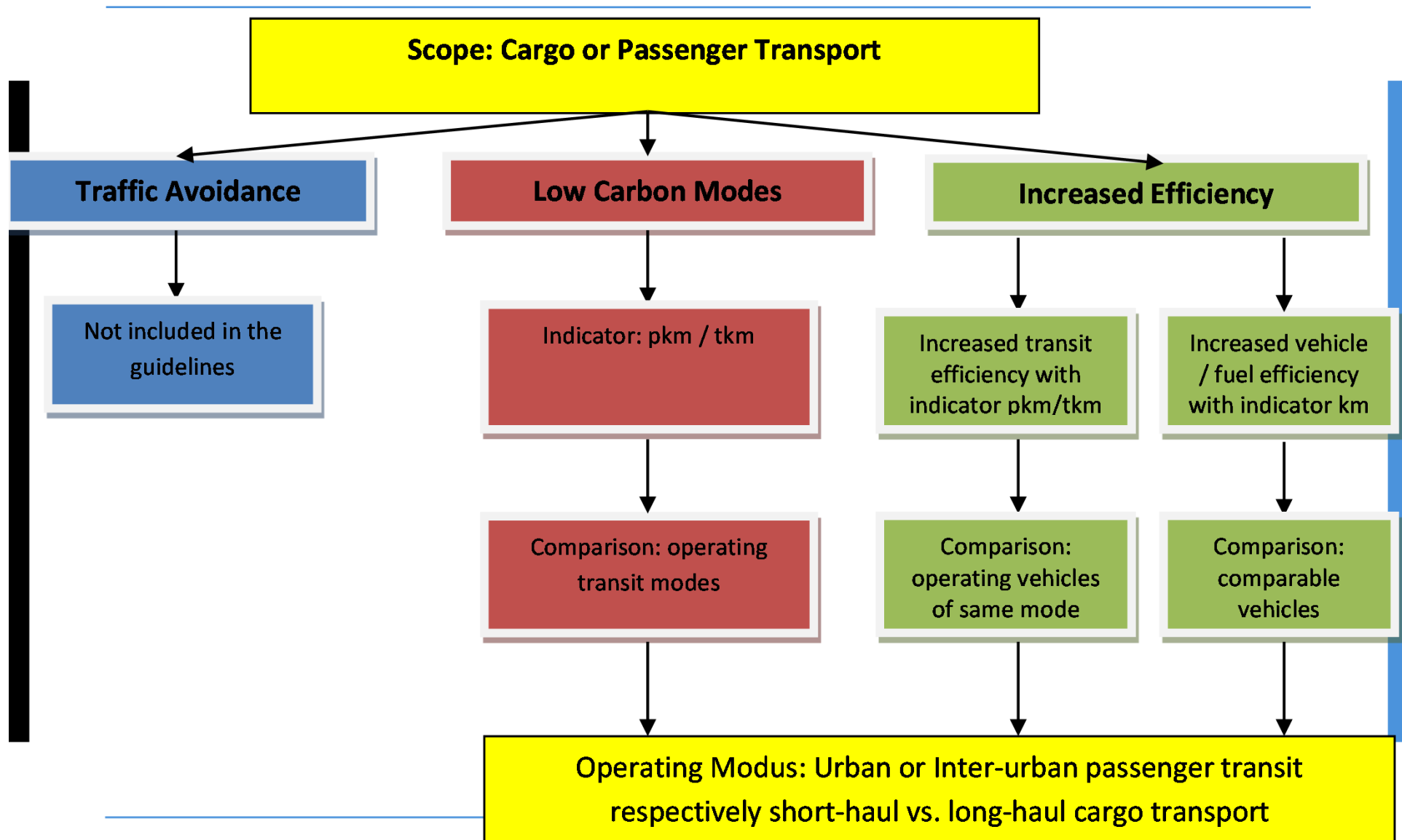
Figure 8.1.6 Typical ranges of direct CO₂ emissions per kilometre for passengers and per tonne-kilometre for freight, for the main transport modes when fuelled by fossil fuels including thermal electricity for rail. Sources: (ADEME, 2007; US DoT, 2010; Der Boer et al., 2011; NTM, 2012; WBCSD, 2012)

Standardized baselines for stationary emission sources- SB guidelines

General Approach



Discussion on first draft paper
Expansion of the scope of guidelines to transport sector: Measures covered



Expansion of the scope of guidelines to transport sector: Data requirements

Level 1

- EF per km for various modes e.g. cars, taxis, buses, trucks, motorcycles based on fuel consumption, NCV, and EF per fuel type
- Requires default values for fuel consumption per vehicle category or measurements
- Example: 160 gCO₂/km for passenger car
- Used for vehicle/fuel efficiency measures in cargo or passenger transport

Level 2

- EF per PKM and EF per tkm based on average occupancy/load factor rate per mode of transit
- Requires occupancy rate studies or data on average trip distance and mass of persons/cargo transported
- Example: 90 gCO₂/PKM for passenger cars
- Used for transit efficiency measures in cargo or passenger transport

Level 3

- EF per PKM and per tkm for passenger transit and for freight
- Requires data on modal share (per PKM or per tkm) e.g. 60% bus, 30% car, 10% motorcycle.
- Example: 40 gCO₂/PKM average EF for motorized transit of passengers
- Used for low carbon mode measures in cargo or passenger transport

Expansion of the scope of guidelines to transport sector: Sampling requirements

Geographical scope

- Country
 - >10 cities with > 1 mln. inhabitants
- Geographic region
 - Asia, Middle East and North Africa, Africa, and Latin America & the Caribbean
- LDCs
 - LDCs all together

Sample determination

- Random selection of countries (min. 5 countries)
- Cities > 250,000 inhabitants
- Alphabetic order: taking nth city
- # of cities: whichever larger
 - not less than 10 cities
 - not less than 10% of all cities in geographic region
- Weighting factor: based on city population
- **Standardized baseline:** the lower 95% confidence interval of sample
- **Additionality threshold:** lowest 20 percentile of measured standardized baseline EF

