

MRV Transport Sector

Dr. Jürg M. Grütter
jgruetter@gmail.com
www.transport-ghg.com

grütter
— consulting

matching transport with carbon finance

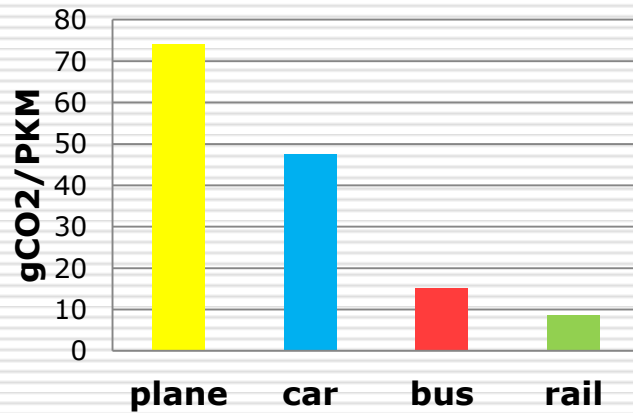
Outline

- ❑ Why monitor
- ❑ General principles
- ❑ Approaches to monitoring transport
- ❑ Activity based indicator set
- ❑ Project based versus sector-based monitoring
- ❑ Links to NAMAs
- ❑ Organisational structure
- ❑ Steps forward

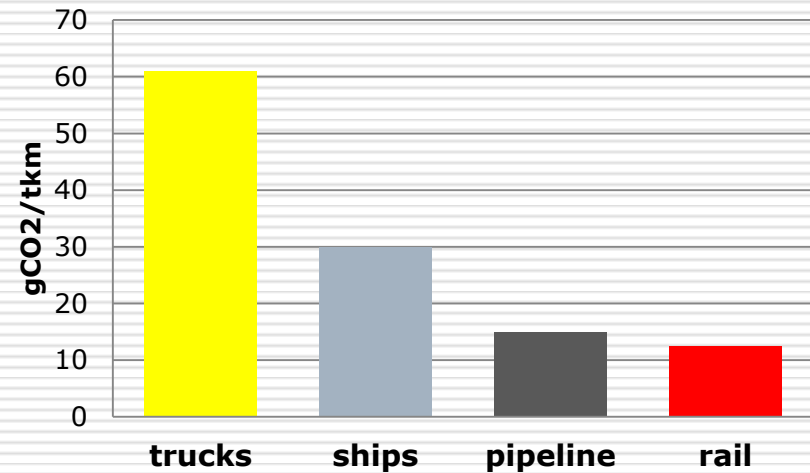
Why Monitor

- Transport activity related data is needed to:
 - Evaluate, assess and improve policies and strategies in the transport sector
 - Improve planning of transportation measures
 - Realize more realistic and accurate projections of the transportation sector
 - Improve usage of resources as these can be targeted to measures with a high impact and cost-effectiveness
 - Gain better access to carbon finance
- What we measure we can assess and improve...
- With data we will know if the transport sector is on track towards a more sustainable system

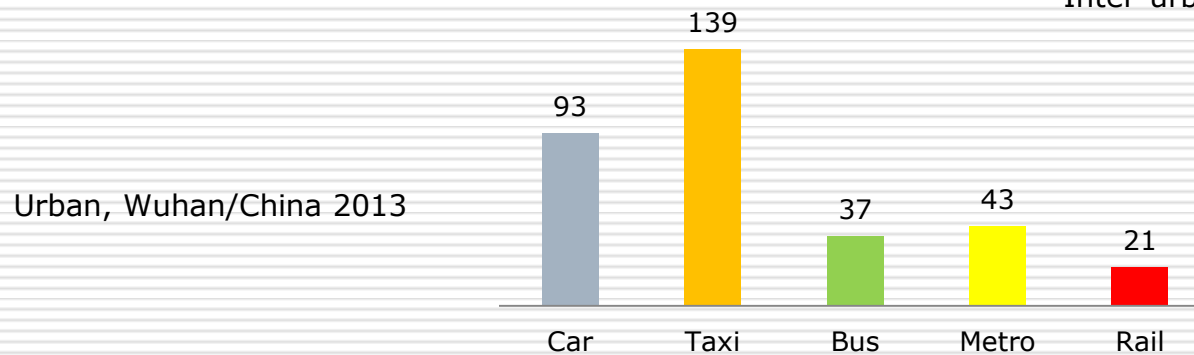
Measure move towards sustainable transport....



Inter-urban India 2013

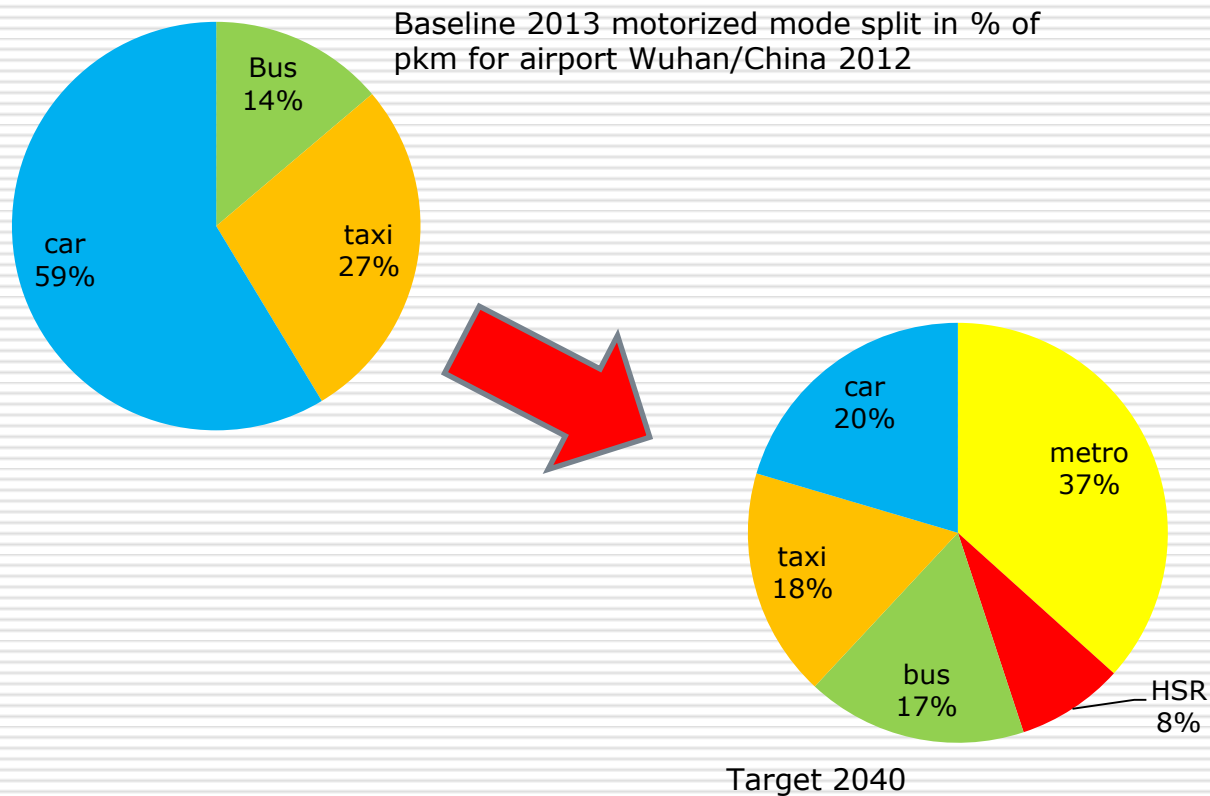


Inter-urban India 2013

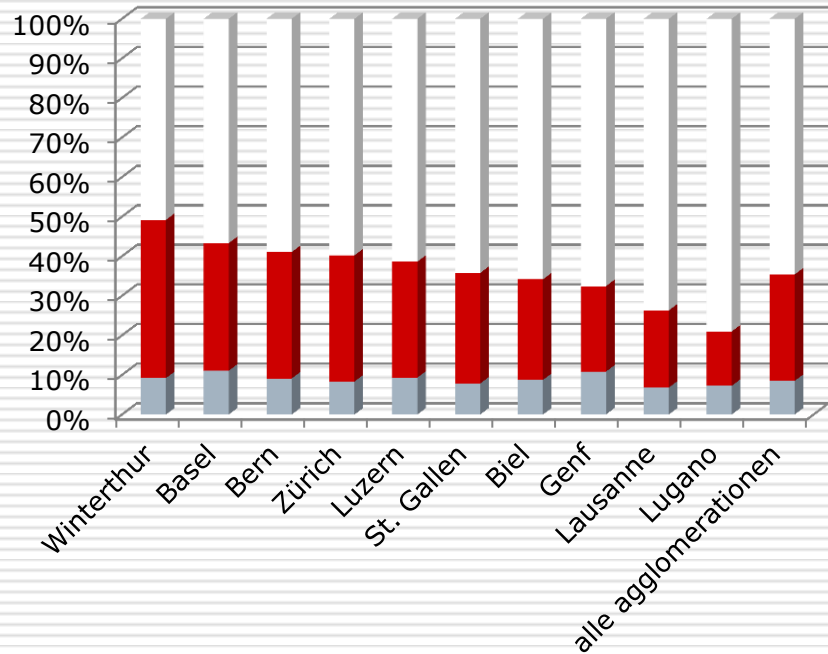


Urban, Wuhan/China 2013

Propose and monitor targets....

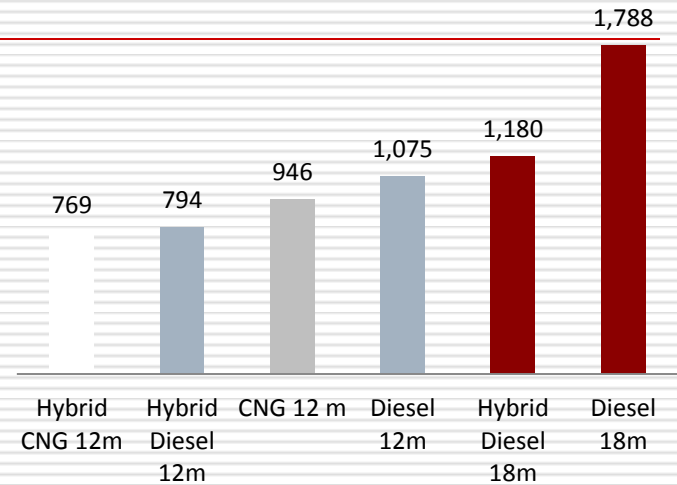


Compare and improve....

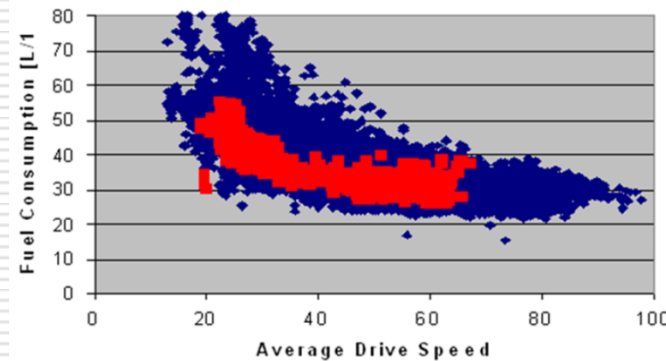


Mode share Swiss cities 2012 in % of PKM

white: car; red: PUT; grey: NMT



GHG WTW emissions of buses in gCO₂/km in Zhengzhou, China, 2013

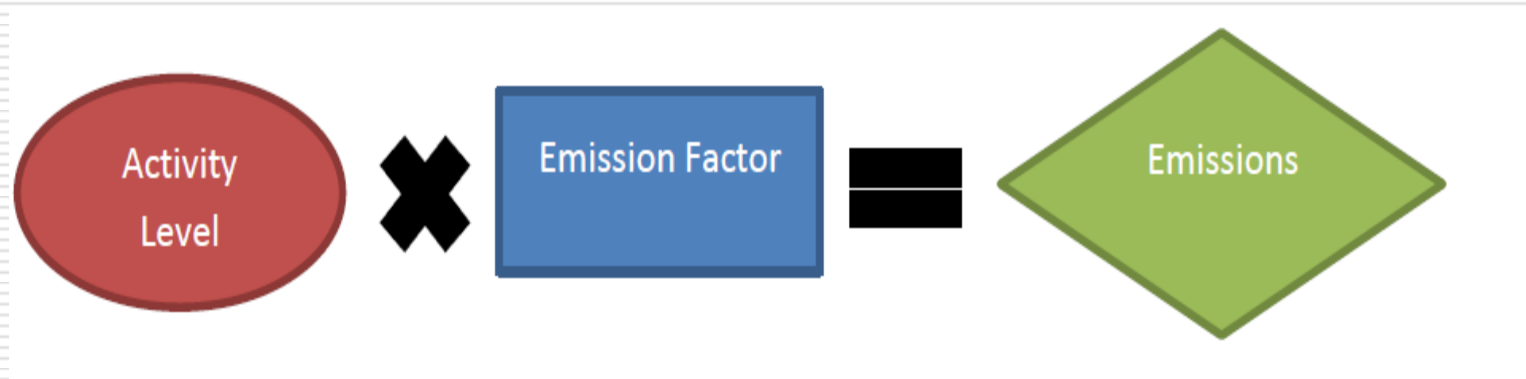


Principles

- Objective, transparent, replicable
- Consistent
- Relevant
- Reliable, robust, accurate, measurable
- Available, accessible
- Cost-effective

Approaches

- Top-down: fuel/energy consumption
- Bottom-up: activity based approach



Top-Down Approach

- ❑ Based on fuel consumption
- ❑ IPCC guidelines; used for GHG inventory
- ❑ Usefulness limited as not linked to sub sectors (e.g. freight, urban) nor actions or strategies; influenced by many external factors (e.g. GDP growth, population growth, fuel prices etc)
- ❑ Reliability limited as fuels used in transport sector are also used in other areas:
 - Gasoline: OK; basically passenger transport
 - Diesel: usage also industry, agriculture, energy production; used both in freight as well as pax transport
 - Gaseous fuels: usage also in households, industry (especially LPG difficult to separate); freight as well as pax transport
 - Electricity: not related to transport in general in statistics but to the energy sector; however rail, metro and increasingly road vehicles (incl. hybrids) use electricity
- ❑ However top down data is useful for plausibility check of some bottom-up data

Bottom-Up

- Activity related
- The ASIF framework can be used (Activity; Structure/mode share; Intensity; Fuel mix)
- Can quantify transport impacts and relate them to policies and strategies

What to Monitor

Passenger



Urban



Freight



Inter-urban



Why separations:

- Different actors and stakeholders
- Different actions, strategies, policies
- Different indicators and measurement approaches
- However some overlap e.g. fuel policies, vehicle certification

General Indicators

- Vehicle registration; core aspects
 - Vehicle classes (e.g. small, medium large bus; truck categories)
 - Fuel types (take care of conversions e.g. CNG)
 - Age
 - Emission standard
 - Discard vehicles not used anymore
 - Best annual based on e.g. tax
- Fuels
 - Fuel quantities (gasoline, diesel, gaseous, electricity)
 - Biofuels (types and blending %)
- Emission factors of fuels:
 - for CO₂ based on NCV and EF_{CO_2}
 - for CH₄ based on vehicle technology (only for gaseous vehicles relevant)
 - N₂O not relevant
 - Can be based on IPCC defaults

Freight Core Indicators General

- Overall indicator: emissions per tkm
- Ton kilometer: 1 tkm = 1 ton moved 1 km
- Levels
 - Activity: tkm
 - Emissions: gCO₂/tkm

Freight Core Indicators Elements

- Activity level (tkm) per mode: road, rail, ship, air, pipeline:
 - Rail, ship, air, pipeline: Stats on tons and average trip length: relatively easy available as centralized
 - Road:
 - Many actors (logistics companies, «truckers», industrial and commercial companies with property fleets)
 - Basically required:
 1. Average load factor
 2. Distance travelled by vehicles
 3. Number of trucks per category with average carrying capacity
 - Sources are surveys, on-road measurements, on-board instrumentation
- Emission factor per mode: requires SFC per mode; sources are company reports, official stats, sample measurements, default values

Passenger Transport Indicators General

- Overall indicator: emissions per person and per pkm
- Levels
 - Inhabitants
 - Activity: pkm
 - Emissions: gCO₂/pkm
- Avoidance is monitored (at least for urban)
- Separation in urban and inter-urban (different EF, actors, policies, measurement approaches)

Passenger Core Indicators Inter-Urban

- Activity level (pkm) per mode: road, rail, air, (ship):
 - Rail, air, (ship) : Stats on passengers and average trip length: relatively easy available as centralized
 - Road various modes: bus, car (main)
 - Basically required: Average occupation rates, distance travelled and number of units per mode OR average trip distance of passenger (not vehicle) and nu. of passengers per mode
 - Sources are company data (bus companies), surveys, on-road sample measurements
- Emission factor per mode: requires SFC per mode for inter-urban traffic; sources are company reports, official stats, sample measurements, default values

Passenger Transport Urban Indicators I

□ 3 levels

- Emissions per vehicle per mode (CO₂ per km)
- Emissions per trip (CO₂ per pkm)
- Emissions per person (CO₂ per inhabitant)

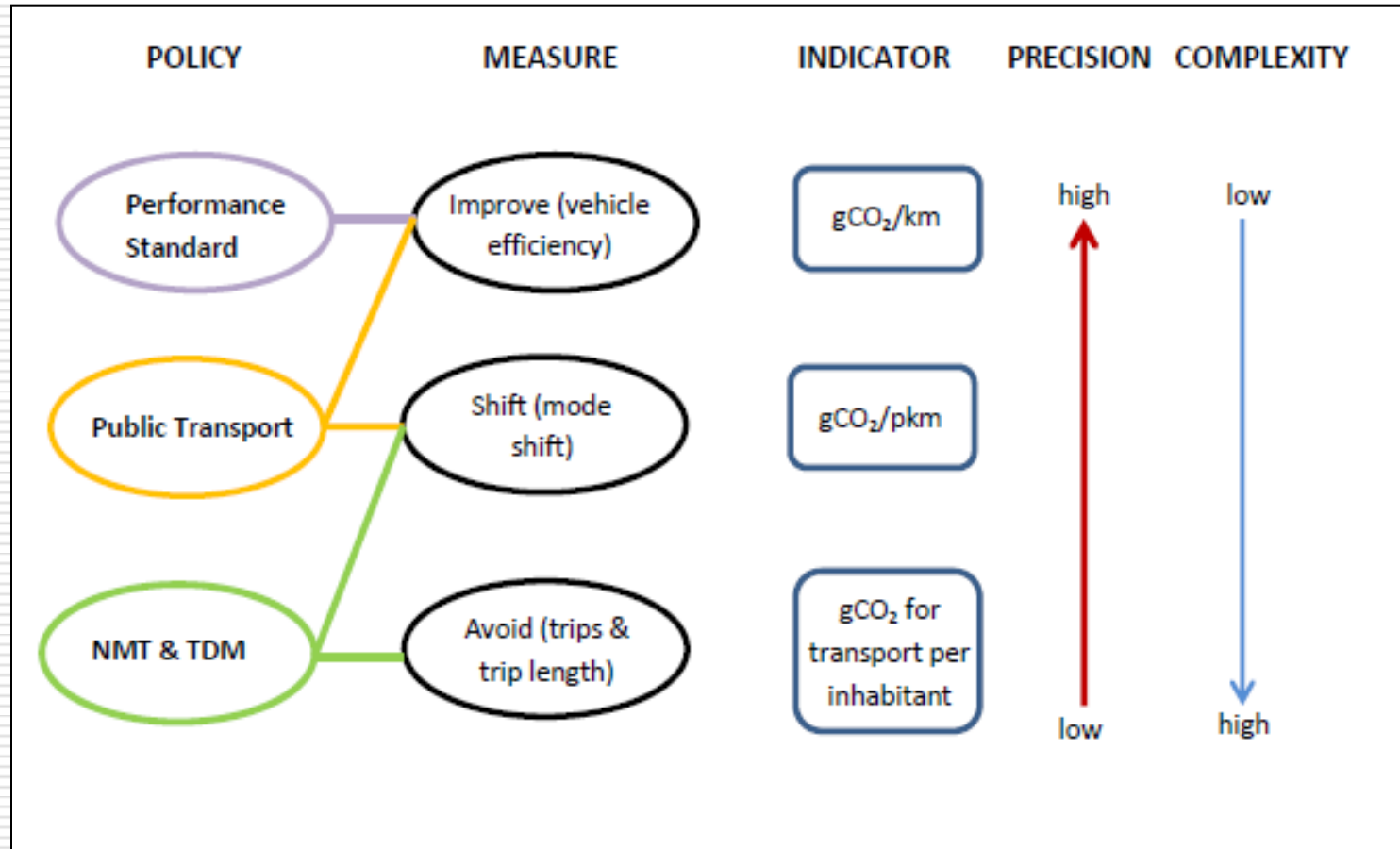
□ Emissions per vehicle (CO₂ per km)

- Measures vehicle efficiency (specific per mode) and total vehicle emissions (absolute)
- Typical modes: buses (potentially sub-categories), taxis, motorcycles, 3-wheelers, private cars, rail-based transport (metro, LRT, (sub)urban rail, tram)
- Requires information on SFC per mode per fuel type
- For absolute numbers you require also:
 - Number of vehicles per mode
 - Annual average distance driven per mode
 - or absolute fuel usage per mode (e.g. rail, eventually Public Transit)
- Sources are sample measurements, on-board equipment, company information (e.g. taxis, buses, rail), defaults

Passenger Transport Urban Indicators II

- Emissions per trip (CO₂ per pkm)
 - Measures trip efficiency and mode share
 - Include also NMT
 - Requires information on average occupation rate per mode, distance travelled per vehicle per mode and number of vehicles OR average trip distance of passenger per mode and number of passengers
 - Total pkm required to monitor mode share: beware mode share is reported based on number of trips and based on pkm
 - Sources are company data (bus companies), household and other surveys, on-road sample measurements
- Emissions per person (CO₂ per inhabitant)
 - Measures system efficiency
 - Includes trips avoided or shorter trips
 - Requires benchmark / baseline
 - Is based on total pkm per motorized mode and emission factor per mode plus number of inhabitants
 - Source basically household surveys

Passenger Transport



Activity Indicators

- Monitor Input and are important explanatory elements (cause-effect)
- Include financial inputs and physical inputs
- Real (ex-post) and not planned values
- Include for finance:
 - Investment in transport
 - Investment in rail and shipping
 - Investment in public urban transport
 - Investment in MRTS
 - Investment in NMT
- Include for physical:
 - Km built in MRTS (separate metro, LRT/tram and BRT)
 - Km built in inter urban rail separating HSR
 - Km built of separate bike lanes
 - These indicators are also listed in ISO 37120:2014 for sustainable development of communities

Sustainable Development Indicators

- Important for entire picture
- Core parameters:
 - Economic: time usage in transport (especially urban)
 - Social: transport fatality rate per mode per 1Mkm
 - Environment: air quality (impact on health i.e. social and economic and urban on buildings)

Project Vs Sectoral Monitoring

- ❑ Project monitoring is activity related and mainly singular
- ❑ CDM project based approach

	Project	Sectoral
Advantage	<ul style="list-style-type: none">• Impact of singular activity is known• Can be simpler to measure• Project budget available for monitoring	<ul style="list-style-type: none">• Captures impact of strategy or policy• Includes synergy and leakage impacts• Boundary establishment clear
Disadvantage	<ul style="list-style-type: none">• Synergy / leakage effects difficult to capture• Many external factors influence project• ad-hoc monitoring	<ul style="list-style-type: none">• Needs continuous and consistent monitoring• Difficult to get financial resources

Links to NAMAs

- ❑ NAMAs can be individual projects: the core idea is however transformational changes towards a green growth society which implies sectoral and structural changes
- ❑ MR for NAMAs thus more apt on a sectoral level to capture the impact of a policy or strategy
- ❑ NAMAs can be used to build up and finance a monitoring structure if NAMAs are not too narrow and too activity / project focused

Organisational Structure

- Various institutions involved:
 - Ministry of transport
 - Ministry of energy / fuels
 - Ministry of environment
 - Statistical department
 - Urban development
 - Rail/shipping/air authorities
 - Universities, research institutions, private enterprise
- Main however or coordination: Transport Ministry
- At City level transport authority

Steps Forward

- ❑ Assess status quo: Make a complete list of all transport data collected in a regular and official form (data parameter, frequency, organisation in charge, consistency, data quality)
- ❑ Agree upon core indicators to be monitored
- ❑ Make a step-by-step approach e.g. focus first on urban passenger transport
- ❑ Use NAMAs as vehicles to kick-start financing of MRV

Summary Indicators

ID	Area	Indicator
1	Overall	Vehicle registration data
2		Total fuel consumption per fuel type
3		Biofuel content
4		Specific fuel consumption per mode
5		Carbon emission factor per fuel
6		GDP, population data
7		Transport fatality rate per mode
8	Freight	Tkm per mode → is sum of various other indicators incl. average lead, tons of freight, average load factor, distance driven of trucks
9	Passenger inter-urban	Pkm per mode inter-urban → is sum of various other indicators incl. average trip length, number of passengers, average occupation rate, distance driven of cars and buses
10	Passenger urban	Pkm per mode urban → is sum of various other indicators incl. average trip length, number of passengers, average occupation rate, distance driven of various modes
11		Emissions per inhabitant → is sum of various other indicators incl. average trip length per mode and emission per mode per km
12		Air quality
13		Time used in transport