MRV of measures in the transport sector

New Passenger and Freight Transport Volume of the Compendium of GHG Baselines and Monitoring

Webinar

Urda Eichhorst
Transport & Climate Change Advisor, GIZ
Control Panel – important functions

**Grab Tab**: From the Grab Tab, you can

1. hide the Control Panel,
2. mute yourself (if you have been unmuted by the organizer),
3. view the webinar in full screen,
4. raise your hand and
5. change language.

**Audio Pane**: Use the Audio pane to switch between Telephone and Mic & Speakers. In our case we do not use the Telephone.

**Questions Pane**: Type questions to the presenters and click „send“.
Agenda (90 minutes)

1. **Background to the Compendium of GHG Baselines Monitoring & introduction to GIZ’s work on MRV in the transport sector**  
   Urda Eichhorst (GIZ)

2. **The Passenger and Freight Transport Volume**  
   Chuck Kooshian (CCAP)

3. **MRV of Transport Measures – Linkages to (bottom-up) GHG inventories of mobile source emissions**  
   Marion Vieweg-Mersmann (Current Future)

4. **Q&A**
The Compendium on GHG Baselines and Monitoring

- UNFCCC Secretariat (Coordinator)
- World Bank
- WRI
- FAO
- UNDP
- IRENA
- Fundación Torcuato Di Tella
- Swedish Energy Agency
- GIZ
Current volumes of the Compendium

- National level mitigation actions
- **Passenger and freight transport**
- Agriculture, forestry and other land use (forthcoming)
- Manufacturing industry and construction (forthcoming)
- Residential, commercial and institutional buildings (forthcoming)

→ Wide range of mitigation actions
  - Economy-wide emission reduction targets
  - Sectoral-level
  - Sub-sectoral
  - Project- or facility-level
Work of GIZ on MRV in transport

- Expert Group on MRV
- Navigating Transport NAMAs – MRV chapter
- Reference Document on MRV in Transport
- MRV Blueprints for transport mitigation actions
- MRV concepts for transport NAMAs
- Trainings on national bottom-up GHG inventories of transport emissions
  → Advancing Transport Climate Strategies project
GIZ’s Guidance on MRV in Transport

2015: Navigating Transport NAMAs: Handbook (Chapter 2: MRV)
→ offers practical advice on NAMA selection, MRV, finance and registration. It builds upon a high number of examples

2016: Reference Document on MRV in Transport
→ Guidance on how to develop comprehensive and consistent national systems for MRV of transport related emissions

2017: Bottom-Up GHG Inventory and MRV of Measures
→ Explains synergies and limitations of using transport sector bottom-up GHG inventories for the MRV of measures

2017: Compendium on GHG Baselines and Monitoring
→ Guidance on available methodologies for MRV of transport mitigation actions
Systematically supporting climate change policy and actions in transport

Advancing Transport Climate Strategies

- Dialogue with developing countries
- Inventories
- Scenarios
- Emission monitoring
- MRV knowledge mg’t

Sectoral transport climate Strategy

Mitigation action Proposal

- In depth appraisal
- Financing options
- Ex-ante impact assessment
- Stakeholder participation

MRV Expert Group

National and/or international funding

- Implementation of mitigation action
- Institutional and financial set-up
- Reporting
- Verification

Mitigation action Implementation

www.transport-namas.org
Chuck Kooshian

… works with national and local officials around the world to develop transportation and land policies to reduce greenhouse gas emissions and improve the quality of life in the future. Chuck’s interest is documenting how urban form affects the economic and other benefits that a city provides to households, businesses and governments. He has had more than 20 years’ experience in transportation and land use planning for regional and local government in the US before joining CCAP.
Variables that affect PKM are called **Activity**;

The variables that affect VKT by mode are called mode **Share**;

Fuel efficiency variables that affect fuel use are called **Intensity**;

Emission factor variables affecting GHG are called **Fuel**.

This leads to the following equation:

\[ \text{Total GHG} = A \times S_i \times I_i \times F_{i,j} \]

Where:

- **A** is total Transport Activity (in PKM)
- **S** is share of PKM by mode (i)
- **I** is fuel efficiency by mode (i)
- **F** is emissions per unit of fuel by mode and type of fuel (i,j)
- **i** is mode
- **j** is type of fuel
MITIGATION ACTIONS ARE GROUPED BY MAIN EFFECT
ALSO MUST CONSIDER SCALE, MODES AFFECTED, ETC

- Intra-urban mass rapid transit investments
- Alternative fuels incentives
PREDICTING BASELINES AND MEASURING ACTUAL EMISSIONS DONE FOR VARIOUS PURPOSES

**Ex-ante analysis is done before action occurs**

**Ex-post analysis is done after or during action**

<table>
<thead>
<tr>
<th>Ex-ante</th>
<th>Ex-post</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prioritizing policies</td>
<td>Learning from experience</td>
</tr>
<tr>
<td>Preparing mitigation plans</td>
<td>Reporting results</td>
</tr>
<tr>
<td>Seeking support for actions</td>
<td>Emissions trading</td>
</tr>
</tbody>
</table>
GUIDE TO TOOLS BY TYPE AND PURPOSE
for each group of actions

Navigating classes of available methods and associated tools actions

- Objective
- Level of accuracy
- Nature of tool
- Objective of analysis

In addition to the maps, the Volume also has a tabular guide.

Navigation maps help users judge:

- Level of accuracy
- Objective of analysis
- Nature of tool

In addition to the maps, the Volume also has a tabular guide.
STARTS WITH OUTLINE OF THE CAUSE IMPACT CHAIN

Shows the variables that are targeted by the mitigation action components and how they should be affected

Includes upstream emissions
ANOTHER CAUSE IMPACT CHAIN

Mass Transit Investments Causal Chain

- **Actions**
  - New mass transit infrastructure
  - Update mass transit vehicles

- **Effects**
  - Induced trips from more capacity
  - Public transport mode share
  - Occupancy of public transport
  - Occupancy of other buses and taxis
  - Fuel efficiency from updated public transport vehicles
  - Fuel efficiency due to reduced congestion

- **Indicators**
  - Trips
    - Persons
    - Trips/Person
    - Km/Trip
    - Trips/Mode
  - Load factor/Occupancy
  - Vehicles
    - Number of veh./Type
    - Km/Vehicle type
  - Emissions
    - Fuel/Km
  - Fuel use
    - GHG/Fuel
  - GHG emissions

Includes rebound or leakage effects
NAVIGATION MAP OF AVAILABLE TOOLS

Navigating classes of available methods and associated tools for comprehensive urban transport programmes and plans

<table>
<thead>
<tr>
<th>Objective</th>
<th>Lower accuracy</th>
<th>Medium accuracy</th>
<th>Higher accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ex-ante</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Prioritize policies</td>
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<tr>
<td>Mitigation planning</td>
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<tr>
<td>Report results</td>
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<tr>
<td>Emissions trading</td>
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</tr>
</tbody>
</table>

**Ex-ante**
- **Prioritize policies**
  - Spreadsheets with defaults
  - TEEMP City Sketch Analysis
  - CCAP Emissions Guidebook

**Mitigation planning**
- Spreadsheets with local data
  - Bikesharing-TEEMP
  - Bikeways-TEEMP
  - Walkability-TEEMP

**Report results**
- Other bottom-up methodologies/guidance
  - Colombia TOD NAMA Methodology
  - MRV Blueprint - Sustainable Urban Transport Programmes
  - San José Urban Transport NAMA
  - The Tool for the Rapid Assessment of Urban Mobility in Cities with Data Scarcity (TRAM)

**Emissions trading**

- Spreadsheet or software tool
- Guidance document

**Shows the tools that are available.**

**Additional text and tables give further information about obtaining and using appropriate tools.**
### ADDITIONAL GUIDANCE FOR TOOLS, DATA AND ANALYSIS

#### Navigating classes of available methods and associated tools of freight modal shift mitigation actions

<table>
<thead>
<tr>
<th>Objective</th>
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<th>Medium accuracy</th>
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</tr>
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<tr>
<td>Report results</td>
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<tr>
<td>Emissions trading</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Spreadsheet or online tool**
- **Guidance_documentation**

#### Actions with potential for double counting of freight modal shift mitigation actions

<table>
<thead>
<tr>
<th>Mitigation action</th>
<th>May affect this variable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freight (taxes or subsidy removal)</td>
<td>Mode share</td>
</tr>
<tr>
<td>Logistics facilities investment</td>
<td>Induced trips, mode share</td>
</tr>
<tr>
<td>Fuel economy standards or measures for trucks</td>
<td>Mode share, truck transport costs</td>
</tr>
<tr>
<td>Improved logistics practices (e.g., alliances of small truckers)</td>
<td>Mode share, truck transport costs</td>
</tr>
</tbody>
</table>

#### Degree of local data disaggregation and context variables

<table>
<thead>
<tr>
<th>Lower accuracy</th>
<th>Medium accuracy</th>
<th>Higher accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transport activity data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emission factors</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Additional Guidance for Tools, Data and Analysis

<table>
<thead>
<tr>
<th>Name</th>
<th>Application / summary</th>
<th>Scope</th>
<th>Computer based</th>
<th>Methodology documentation</th>
<th>Data collection guidance</th>
<th>Defaults Provided</th>
<th>Cost of tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATiMR</td>
<td>Shift cargo among trucks, barges, ships and trains</td>
<td>Ex-post, upstream including construction, electric grid factor</td>
<td>No</td>
<td>Good</td>
<td>Brief “Measurement procedures” for all variables</td>
<td>Default emission factors for diesel trucks, barges, and ship fuel aids</td>
<td>Free</td>
</tr>
<tr>
<td>COM</td>
<td>Modal shift from road to water, rail, or air transport and freight mode shift</td>
<td>Ex-post, no upstream emissions except electric grid factor</td>
<td>No</td>
<td>Good</td>
<td>Brief “Measurement procedures” for only some variables</td>
<td>Default emission factors for rail, water, and road disaggregated by some cargo types</td>
<td>High</td>
</tr>
<tr>
<td>NMR</td>
<td>National rail infrastructure programme</td>
<td>Passenger and freight mode shift from road to rail</td>
<td>No</td>
<td>Very Good</td>
<td>Good, brief recommendations for data sources at national level</td>
<td>No</td>
<td>High</td>
</tr>
<tr>
<td>LSMM</td>
<td>Shift in mode of transportation of liquid fuels</td>
<td>Ex-post, includes upstream electric emissions</td>
<td>No</td>
<td>Good</td>
<td>Brief “Measurement procedures” for only some variables</td>
<td>Includes a single default value for truck fuels</td>
<td>High</td>
</tr>
</tbody>
</table>
CURRENTLY INCLUDES EIGHT CATEGORIES OF MITIGATION ACTIONS GROUPED BY EFFECT/MODES

1. Intra-urban mass rapid transit investments
2. Comprehensive urban transport programmes
3. Vehicle efficiency improvement programmes
4. Alternative fuels incentives
5. Inter-urban rail infrastructure
6. Freight transport infrastructure investments to shift mode
7. National fuel economy standards
8. Pricing policies (forthcoming)
ADDITIONAL METHODOLOGIES CAN STILL BE ADDED.

If you know of a methodology that might be included in the compendium please contact: Urda Eichhorst (urda.eichhorst@giz.de)
ACCESS ONLINE

Compendium on GHG Baselines and Monitoring
• Available at: http://namanews.org

ALSO AVAILABLE

Comprehensive database of transport GHG methodologies, tools and guidance

SLoCaT Transport GHG Methodology guide
• Available at: http://www.slocat.net/documents
THANK YOU

For more information contact

Chuck Kooshian
ckooshian@ccap.org

www.ccap.org
Marion Vieweg

... specialises in transparency, policy analysis, mitigation, and the link to sustainable development. She focuses on the UNFCCC negotiations, its transparency provisions and options to enhance the level of ambition. She led the Climate Action Tracker project for 3 years and worked at the UNFCCC supporting the technical analysis of BURs. Marion is member of the Expert Group on MRV of the GIZ Transfer Project and the TWGs for Transformational Change and Transport of the ICAT Initiative.
MRV of transport measures

Linkages to (bottom-up) inventories of mobile source emissions
Outline

• Differences in terminology
• GHG inventories in the transport sector
• Boundary setting for inventories and MRV
• Calculation approaches and data needs for MRV of mitigation
• Examples: using inventory data for the MRV of measures
• Synergies and limitations
**Terminology: activity data**

- The most basic equation for calculating emissions is:
  - \[ \text{Emissions} = \text{Activity} \times \text{Emission factor} \]
- It is important to note that both terms in this equation can be used to specify very different things, for example:
  - Activity = Fuel used (IPCC tier 1)
    - Emission factor CO$_2$e / energy content (TJ)
  - Activity = Distance travelled (IPCC tier 3)
    - Emission factor CO$_2$e / vehicle kilometre (vkt)
- In transport sector MRV “activity” usually refers to the distance travelled, as:
  - Vehicle kilometre (vkt) or
  - Passenger kilometre (pkt) / tonne-km
- It is important to always specify what type of “activity” data is meant.
Terminology: top-down vs. bottom-up

**Input**
- Energy-based
  - Fuel consumption data
  - Emission factors (kgCO₂eq/TJ)
    - based on energy content of fuels

**Top-down approach**

**Comparison**

**Bottom-up approach**
- Mileage-based
  - Distance travelled (VKT)
  - Emission factors (kgCO₂eq/km)
    - based on emissions per distance travelled

• Note that the 1996 IPCC Guidelines have a different definition!
• They determine top-down and bottom-up based on the level of detail, not the input variable.
Transport inventories: Increasing data needs for higher tiers

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Level of detail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emission factor (kg/TJ)</td>
<td>Increasing level of disaggregation by fuel type,</td>
</tr>
<tr>
<td></td>
<td>vehicle type, emission control technology [CO₂, CH₄, N₂O]</td>
</tr>
<tr>
<td>Fuel sold (TJ)</td>
<td>by fuel type</td>
</tr>
<tr>
<td>Distance (km)</td>
<td>Change in type of activity data [CO₂, CH₄, N₂O] by</td>
</tr>
<tr>
<td></td>
<td>fuel type, vehicle type, emission control technology</td>
</tr>
</tbody>
</table>

Top down approach: Energy based

- GHG inventory 1996 IPCC Guidelines
- Change between tiers

Bottom-up approach: Mileage based

- Tier 1
- Tier 2
- Tier 3

The 1996 IPCC guidelines do not explicitly differentiate tier 2 and 3! The methodology is presented for both tiers together and can be based on either fuel or distance. For illustrative purposes we have split the two based on the activity data used and our definition of bottom-up.
Transport inventories: Differences in 2006 IPCC Guidelines

Top down approach

Energy based
- Emission factor (kg/TJ)
- Fuel sold (TJ)

Bottom-up approach

Mileage based
- Distance (km)
- Emissions warm-up phase
- Emission factor (kg/km)

Parameters
- Change in tier 2 method for CO₂
- Additional parameter and higher level of disaggregation

Level of detail
- [CH₄, N₂O]
  - by fuel type, vehicle type, emission control technology
- [CO₂]
  - by fuel type: Country-specific
- No tier 3 method for CO₂

GHG inventory 1996 IPCC Guidelines

Change between tiers

Tier 1
- [CO₂]
  - by fuel type

Tier 2
- [CH₄, N₂O]
  - by fuel type, vehicle type, emission control technology, operating conditions

Tier 3
- [CO₂]
  - by fuel type: Country-specific

31/05/2017
Inventories and MRV: Geographic scope

Inventories: national scope

MRV of actions: Corridor, ride shed, urban area, region, national

Potential for overlap between measures

Survey areas for inventory data collection
Inventories and MRV: Upstream / downstream

- Vehicles
  - Vehicle production
  - Fuel production

- Fuel
  - Combustion (carbon content)

- Infrastructure
  - Infrastructure construction
  - Maintenance
  - Operation

- Infrastructure usage
  - Load
  - Traffic condition
  - Engine efficiency

- Activity/Structure
  - Fleet
  - VKT

- Downstream
  - Vehicle scrapping and disposal
  - Infrastructure dismantling

Coverage of inventories

Possible focus for MRV, depending on type of measure

= Main impact
Example 1: national vehicle-based efficiency standards (fuel or emissions)

Targeted parameters depend on details of the regulation
- Applicability to new vehicles or total fleet
- Standards set for fleet or individual vehicle classes

Normally these are
- Fleet composition: distribution between vehicle types
- Fuel efficiency
Data sources for national vehicle-based efficiency standards (fuel or emissions)

- **Trips**
  - persons
  - trips/person
  - km/trip
  - trips/mode
  - load factor/occupancy

- **Vehicles**
  - number of veh./type/ECT
  - km/vehicletype/ECT

- **Emission factors**
  - fuel/km
  - GHG/fuel

- **Ex-ante**
  - Inventory tier 2/3
    - Fleet composition disaggregated
  - Fuel efficiency disaggregated
  - All other parameters: average values/defaults

- **Ex-post**
  - Inventory tier 3
    - Distance travelled (vkt) disaggregated
  - Other sources
    - Fuel efficiency disaggregated
    - Emission factors disaggregated

**GHG emissions**
Limitations

- For sub-national measures the difference in geographic scope will limit usability of inventory data, particularly for ex-post assessment.
- For measures including electric forms of transport (e.g. metro, electric cars), the sectoral scope of inventories will require additional data collection to complement inventory data.
- The same is the case for measures involving a switch to biofuels.
- For ex-post assessment more detailed information than available in the inventory is required in many cases.
Synergies

- Data collected for the MRV of measures can be used to supplement available national level data
- If coordinated between different measures/geographic regions, data collected for the MRV of measures can provide a representative sample that can be used to estimate national values
- Data collected for tier 2 and 3 inventories can often be used as an approximation for estimating effects of measures ex-ante
- To maximize synergies
  - Data definitions and collection methods need to be harmonized
  - Frequency and timing needs to be aligned
  - Data formats and calculation methods used should be consistent
  - Institutional cooperation should be formalized
Launch of the Passenger and Freight Transport Volume Compendium of GHG Baselines and Monitoring

Guidance on available methodologies for MRV of transport mitigation actions

Download at: