Advancing Transport Climate Strategies in Rapidly Motorising Countries (TraCS) Project

Insights from GIZ’s support on establishing GHG inventory and developing future scenarios in Viet Nam

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International BUR Champions Workshops
Training on data access and MRV in the transport sector
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Content

• Project overview
• Challenges, open issues and next steps
• Calculation exercise
‘If you cannot measure it, you cannot improve it’

Lord Kelvin 1824 - 1907
Advancing Transport Climate Strategies (TraCS)

**Funding:** International Climate Initiative of the German Ministry for Environment

**Countries:** Global project, Viet Nam and Kenya (tbc)

**Partners:** Viet Nam Ministry of Transport

GIZ, Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH

**Time:** 06/2016 - 01/2019

Global level activities

- Methodologies & tools for MRV (e.g. emission factors and default data)
- Analysis of INDCs and dialogue between stakeholder
- Dissemination to further countries

Support countries in mitigation in the transport sector at strategic national level and improve emission quantification & monitoring capacities

Country 1: Viet Nam
- Data processing and management
- Transport emission inventory
- Development of scenarios and sectoral action plan

Country 2: Kenya
- Support establishing a climate desk at MoT
- Planning workshop on April 4/5, 2017
Background information on Viet Nam

- **Transport**: Accounts for 23% of Viet Nam’s total energy-based emissions and is highlighted as a focus area in Viet Nam’s Intended Nationally Determined Contribution (INDC).

- **National GHG emission reduction goal**: by 8% by 2030 compared to the Business as Usual (BAU) scenario using domestic resources; 25% with international support.

- In 2016, Viet Nam signed the Paris Agreement and established a national plan for its implementation.

- As part of the so-called “Non-Annex I Parties”, Viet Nam is required to submit a national inventory of man-made GHG emissions to the UNFCCC.
GIZ support on inventory

Prime Minister

assignes

MONRE
- GHG inventory
- BUR 2

GSO

reportson Ministry of Transport (MoT)

Department of Environment (DOE)

set up

Other line ministries

supports

GHG inventory working group

Subgroup aviation
Subgroup road
Subgroup rail
Subgroup maritime
Subgroup inland waterways

data collection, modeling
TraCS in Vietnam

Emission Inventory (bottom-up)
- Collect data
- Compile data in database/model
- Regular update and report

Baseline Scenario (bottom-up)
- Based on (I)NDC baseline scenario (GDP, population, etc.)
- Model travel activity and fleet composition

Mitigation Scenario
- Define policies & measures
- Describe impact
- Collect further specific data

2016 - 2017 - 2018 - 2019 - >
Terminology: top-down vs. bottom-up

Comparison

Input

Top down approach
Energy based

Bottom-up approach
Activity based

Calculation of GHG emissions:

Emission factor × Total fuel consumption

default values (IPCC Tier 1)

National energy balance

Total Activity × Specific fuel consumption = Total fuel consumption × Emission factor

e.g. VKT=Number of vehicles X average VKT
e.g. l/ 100 km

Registration offices,, Surveys (interviews, tachometer data)

Surveys (interviews, tests)
Terminology: top-down vs. bottom-up

Top down approach

1. Energy sector
   1.A. Fuel Combustion Activities
     1.A.1 Energy industries
     1.A.2 Manufacturing Industries and Construction
   1.B Fugitive emissions from fuels
   1.C Carbon dioxide Transport and Storage
   1.A.5 Non specified

Bottom up approach

1.A.3 Transport sector
   1.A.3.a Civil Aviation
   1.A.3.b Road Transportation
   1.A.3.c Railways
   1.A.3.d Navigation
   1.A.3.e Other Transportation
   1.A.3.b Subcategories
   1.A.3.b.i Passenger Cars
   1.A.3.b.ii Light duty vehicles
   1.A.3.b.iii Heavy duty vehicles and buses
   1.A.3.b.iv Mopeds & Motorcycles
   1.A.3.b.iv evaporative 1 A 3 b vi Urea-based catalysts
   1.A.3.b.i Subcategories
   1.A.3.b.i 1 Passenger Cars with 3-way catalyst
   1.A.3.b.i 2 Passenger Cars without 3-way catalyst

Source: Ifeu 2017 based on IPCC 2006
Subsector Modules

AVIATION TOOL
Top-down approach

RAILWAY TOOL
Top-down approach

ROAD TOOL
Bottom-up approach

MARITIME TOOL
Bottom-up approach

INLAND WATERWAY TOOL
Bottom-up approach

Validation

Merger TOOL
(and scenarios)

Total fuel consumption
Number of ships x average operating hours x average engine power x load factor x engine specific fuel consumption

Emissions
Population x Power x Use x Emission factor
GHG inventory tool

Subsector Modules

AVIATION TOOL
Top-down approach

RAILWAY TOOL
Top-down Approach

ROAD TOOL
Bottom-up approach

MARITIME TOOL
Bottom-up approach

INLAND WATERWAY TOOL
Bottom-up approach

Validation

Merger TOOL
(and scenarios)

Total fuel consumption

Total VKT X Specific Fuel consumption

Emissions

Total fuel consumptionx Emission factor
Example: Data input sheet; road sector tool
Main challenges for data collection

All sectors

- No country-specific emission factors and carbon fuel content available (use of IPCC 2006 values)
- Uncertainties in energy balances and statistic data of the General Statistic Office are causing difficulties for cross-checking/validation

<table>
<thead>
<tr>
<th>Impact on GHG inventory result</th>
<th>Low uncertainty</th>
<th>Medium uncertainty</th>
<th>High uncertainty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low impact</td>
<td>Rail</td>
<td>Maritime</td>
<td></td>
</tr>
<tr>
<td>Medium impact</td>
<td>Aviation</td>
<td>Inland Navigation</td>
<td></td>
</tr>
<tr>
<td>High impact</td>
<td></td>
<td></td>
<td>Road</td>
</tr>
</tbody>
</table>
Main challenges for data collection

1 example: Road Sector

- Only total number of registered number of motorbikes is available, not the total number of vehicles in use
- Default data on vehicle kilometers travelled (VKT) for all vehicle categories are highly uncertain
- No country specific data on specific fuel consumption (use of European values from EMAP/EEA 2016)
- No information about driving behavior and road types
Open issues for inventory development

- Evaluate and minimize uncertainties
  - Improve / verify **population data of motorbikes & inland ships**
  - Improve **performance parameters** (VKT, operating hours, load factors) for bottom-up tools (Road, Inland waterway, Maritime)
  - *If possible*: comparison of bottom-up and top-down results – but energy balances also include high uncertainties!
- **Collect data** for 2013 (BUR 2) and 2014 (Task of WG by Minister)
- **Test tool** and insert data of 2013 / 2014 (and before if possible!)
- Organizing **procedures** for tool maintenance (subsector and merger tool)
Exercise 1
Emission Quantification

Time: 25 minutes
1. Top-down approach

In 2010, city consumed 500.0 million Liter of gasoline, 200.0 million Liter of diesel and 100 tons of Compressed Natural Gas (CNG), and 90% of gasoline, 40% of diesel and 80% of CNG was consumed by transport sector.

Task 1: Please calculate the total tank-to-wheel* greenhouse gas emissions emitted from the transport sector.

*Tank-to-wheel: Emissions from fuel combustion during operation of the vehicle

Well-to wheel: Consisting of “tank-to-wheel and “well-to-tank” (emissions from fuel production and distribution).
<table>
<thead>
<tr>
<th>Fuel Type</th>
<th>Conversion Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>tank-to-wheel</td>
</tr>
<tr>
<td></td>
<td>gCO2/MJ</td>
</tr>
<tr>
<td>Gasoline</td>
<td>73.4</td>
</tr>
<tr>
<td>Ethanol</td>
<td>0</td>
</tr>
<tr>
<td>Diesel</td>
<td>73.3</td>
</tr>
<tr>
<td>Biodiesel</td>
<td>0</td>
</tr>
<tr>
<td>Liquefied Petroleum Gas (LPG)</td>
<td>65.7</td>
</tr>
<tr>
<td>Compressed Natural Gas (CNG)</td>
<td>56.2</td>
</tr>
</tbody>
</table>
2. Bottom-up approach

City A has 500,000 light duty passenger cars, in which 100,000 vehicles are small-sized cars (engine capacity <=1.0L), 300,000 vehicles are medium-sized cars (engine capacity 1.0 -2.0L), and 100,000 vehicles are large-sized cars (engine capacity >2.0L). All cars are fueled by gasoline. Annual average kilometers travelled and average carbon emission factors for each of the three vehicle categories are shown in the below table.

**Task 2: Please calculate the annual greenhouse gas emissions caused by the gasoline-fueled passenger cars.**

<table>
<thead>
<tr>
<th>Vehicle category</th>
<th>Annual average kilometres travelled</th>
<th>Average emission factor (CO2 g/km): tank-to-wheel</th>
</tr>
</thead>
<tbody>
<tr>
<td>small size car</td>
<td>11,000</td>
<td>120</td>
</tr>
<tr>
<td>medium size car</td>
<td>13,000</td>
<td>160</td>
</tr>
<tr>
<td>large size car</td>
<td>15,000</td>
<td>200</td>
</tr>
</tbody>
</table>
Group Task

Compare the tank-to-wheel emissions calculated by using the bottom-up approach with the results based on the top-down approach (only gasoline).

What are reasons for differences between both results?
Solution
Top-down: CO2 Emissions

- **Emissions from Gasoline**
  - \(500.0 \text{ million Liter} \times 90\% \times 2.36 \text{ kg/L} / 1000 = 1,062,000 \text{ ton}\)

- **Emissions from Diesel**
  - \(200.0 \text{ million Liter} \times 40\% \times 2.63 \text{ kg/L} / 1000 = 210,400 \text{ ton}\)

- **Emissions from CNG**
  - \(100 \text{ tons} \times 80\% \times 2.54 \text{ kg/kg} / 1000 = 203 \text{ ton}\)

- **Total**
  - \(1,272,403 \text{ ton}\)
Bottom up: CO2 Emissions

- **Small cars**
  - $100,000 \text{ cars} \times 11,000 \text{ km} \times 120 \text{ g/km} = 132,000 \text{ ton}$

- **Medium cars**
  - $300,000 \text{ cars} \times 13,000 \text{ km} \times 160 \text{ g/km} = 624,000 \text{ ton}$

- **Large cars**
  - $100,000 \text{ cars} \times 15,000 \text{ km} \times 200 \text{ g/km} = 300,000 \text{ ton}$

- **Total**
  - $1,056,000 \text{ ton}$
Our offer: Capacity development

Trainings (also on the job):

- IPCC conform national GHG accounting
- Institutional support for developing national MRV systems
- Sector-specific training on bottom-up GHG accounting
- Model development for bottom-up GHG inventories in the transport sector
- Data collection and maintenance guidance for bottom-up GHG inventories
- MRV of measures

Study tours in Germany:

- Organisation
- Provision of technical inputs
Related knowledge products (GHG inventories and MRV)

- **Reference Document on MRV in Transport**
  Available at: [http://transport-namas.org/](http://transport-namas.org/)

- **GHG Reporting and Inventorying in Germany – Assessing transport related emissions.**

- **Webinar : GHG inventory in the transport sector:**
  [https://www.youtube.com/watch?v=mFlaEp_Ps_8](https://www.youtube.com/watch?v=mFlaEp_Ps_8)

**Upcoming in 2017**

- **Transport Volume, UNFCCC Compendium**

- **Bottom-up GHG Inventory and MRV of Measures – Synergies and Limitations in the Transport Sector**
Thank you!

Please do not hesitate to contact the TraCS project for further questions.

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