User Manual for the MobiliseYourCity Emissions Calculator

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Context of the Publication

This publication has been developed within the MobiliseYourCity Partnership in collaboration with the Institute for Energy and Climate Research Heidelberg (ifeu).

MobiliseYourCity is a partnership for integrated urban development planning in emerging and developing countries under the UN Marrakesh Partnership for Global Climate Action. MobiliseYourCity supports and engages local and national partner governments in improving urban mobility planning & finance by providing a methodological framework and technical assistance, through capacity building, and by enabling access to funding at both local and national levels. Particular attention has been paid to the methodological and advisory frameworks related to National Urban Mobility Policies and/or Programs (NUMPs) and Sustainable Urban Mobility Plans (SUMPs) that serve as the basis for the promotion of investments and development of attractive mobility services.

MobiliseYourCity is a multi-donor action, jointly co-financed by the European Commission's Directorate-General for International Cooperation and Development (DG DEVCO), the French Ministry of Ecological Transition and Solidarity (MTES), the French Facility for Global Environment (FFEM), and the German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB). The initiative is implemented by its founding partners ADEME, AFD, CEREMA, CODATU, and GIZ. Besides contribution to the international climate process, MobiliseYourCity contributes to the UN's Agenda 2030, specifically Sustainable Development Goal (SDG) 11: Make cities inclusive, safe, resilient and sustainable.

The objectives

- Enable transformational changes towards more inclusive, livable, and efficient cities.
- Foster more comprehensive, integrated and participatory urban mobility planning (local & national levels).
- Target reduction of transport-related GHG emissions in participating cities (>50% until 2050).
- Link planning with agreement on investments and optional use of financial assistance.
- Make use of innovative planning techniques and digitalization, and promote state-of-the-art mobility and transport technologies.

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1. Background and purpose of the Tool

The MYC Emissions Calculator aims at helping developing countries and cities to calculate transport GHG emissions for a reference year and Business-as-usual scenario (BAU) as well as a climate scenario with emission reductions from mitigation measures – the so called climate scenario. As a result, the tool provides data on the calculated transport demand, energy consumption and GHG emissions. These data give an overview of the relevance of each transport mode regarding the total GHG emissions within the defined territory. It also enables users to quantify and monitor the impact of a bundle of mitigation actions according to the "ASIF" methodology (Avoid, Shift, Improve and Fuel – see for more details the **Monitoring and reporting approach for GHG emissions** (MobiliseYourCity 2017)). This tool does not aim at calculating the impact of individual mitigation actions. For example the impact of all measures concerning "avoiding" traffic i.e. reduce the need to travel such as home office, removing parking lots, toll systems etc. have to be assessed together per designated year e.g. 2020 and 2030. For example the results of this bundle of measures may be result in a reduction of 2% of car traffic and 3% of delivery truck (both in km). These data are the input required in the climate scenario input sheet.

Please consider that this tool is not designed for transport GHG inventories in the framework of the UNFCCC even if it follows the IPCC guidelines (app.Tier 3 level of the 2006 IPCC guidelines). The results can be used for preparing the inventory for road and rail transport to deliver to the UNFCCC but some aspects should be taken into account or completed beforehand:

1. It only covers GHG emissions (no pollutants included)
2. Biofuels are not included
3. Not all emissions required in the IPCC guidelines for road (1.A3b) and rail are assessed; missing are: evaporative emissions from vehicles (1A3bv) and urea based catalysts (1A3bvi)
4. If the GHG emissions calculation with the tool is used for reporting purposes please use only Tank to wheel emissions (to select in sheet Overview of results)

1.1. Methodology and scope

The scope of the emissions that should be taken into account is based on a territorial principle (see for more details the **Monitoring and reporting approach for GHG emissions** (MobiliseYourCity 2017). Basically all traffic must be taken into account WITHIN the defined territory (traffic of inhabitants, incoming and outgoing traffic such as commuters, tourists, freight deliveries and so on).

The country's or city's transport demand, energy consumption and GHG emissions are calculated with a "Bottom-up" approach i.e. based on the real transport activity data.

With the Bottom-up approach, the total GHG emissions of transport can be derived from multiplying transport demand (Vehicle kilometers travelled – vkt) with the specific energy consumption and the specific GHG emission factor (see Figure 1).

Figure 1: Bottom-up calculation methodology for transport GHG-emissions

Within the tool, road and rail transport both for passengers and freight can be calculated. Furthermore, different vehicle categories (e.g. private cars, taxis, motorcycles, long distance train, Metro) and fuel types (e.g. diesel, gasoline, gas, hybrid and electric) can be distinguished. Figure 2 describes the different vehicle types.

The results of the "bottom-up" calculation of the energy consumed can be compared with the "top-down" energy consumption i.e. fuel sold for transport within the territory. At the national level this data is available in the energy balance.

All data inputs –shown through green cells- are mandatory to use all functionalities of the tool i.e. inventory for base year, BAU and climate scenario as well as Key performance indicators (KPI). If you do not want to use all functionalities, provide compulsory data only for the assessment you want to proceed with (ex: only inventory for base year and BAU -> no data required for climate scenario). Please consider that the inventory is compulsory to calculate BAU and climate scenarios.

Vehicle Category	Description
NMT	NMT = Non Motorized Transport, includes walking and bicycling, using small-wheeled transport (skates, skateboards, push scooters and hand carts) and wheelchairs.
Private car	Any motor vehicle intended for passenger transport, the seat capacity does not exceed nine seats (including driver), the total permissible gross weight does not exceed 3,5t.
Individual taxi	Cars which transport passengers in return for payment of a fare and which are typically fitted with a taximeter.
Motorcycle	A two-wheeled vehicle with an engine.
Motorcycle taxi	Motorcycles which transport passengers in return for payment of a fare (e.g. Go-jek, Grab).
Minibus	Any motor vehicle intended for the collective transport of persons whose number of seats is less than nine, including hirings, collective taxis and rural transportation.
Bus	Any motor vehicle intended for the collective transport of persons, the number of seats of which is greater than nine or the permissible total weight exceeds 3,5t.

BRT	Bus Rapid Transit (BRT) is a high-quality bus-based transit system. It is typically specified with dedicated lanes, iconic stations, off-board fare collection, and fast and frequent operations.
Long distance train	Passenger train mainly traveling outside the city.
Urban train	Passenger train mainly travelling within the city territory – short distance train.
Metro	Passenger train mainly traveling within the city territory – Tram and Metro.
Very light LCV	A mostly three-wheeled motorized vehicle used for goods transport.
LCV	Motor vehicle intended for the transport of freight, the permissible gross weight does not exceed 3,5t.
Solo truck	Motor vehicle intended for the transport of freight, the permissible load is up to 10t.
Articulated truck	Motor vehicle intended for the transport of freight and the total authorized load exceeds 10t. Trucks consist of trucks and tractors (truck with trailer).
Freight train	Any freight train, usually for long distance transport.

Figure 2: Definition of different vehicle types

2. Step-by-step user guide

The MobiliseYourCity Emissions Calculator contains several sheets, which serve different purposes. Sheets "Get started", "1A Input Base and BAU", "2A Input Climat Scen. Pass." and "2B Input Climat Scen. Freight" are the main sheets to be filled in by users. Sheet "1B Top-Down Validation" can be used in order to do a bottom-up - top-down comparison. All further sheets are for informational purposes only. Each sheet will be explained in the sections below. The explanation of each sheet is split into two parts: the first part gives an overview of the **purpose of the sheet** and **general information**, and the third explains the inputs required for calculation.

For some of the input data cells also error checks are embedded within the tool. If a user input seems to be out of the realistic range or is in a wrong data format the user will be informed by a pop-up menu. Within this menu, the user has the choice to either change or apply the input value (see Figure 3).
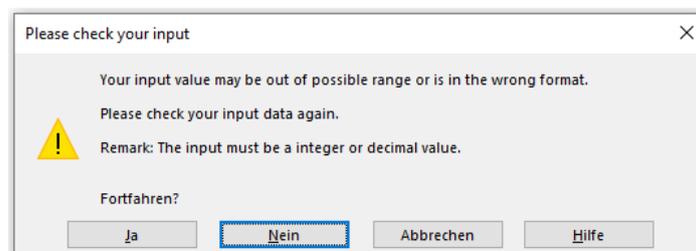
Figure 3: Example for an embedded error check

2.1. Sheet „Get Started"

Important set-up options have to be given (see below)

General information: This sheet contains the defined color code, which is used within all sheets of the MobiliseYourCity Emissions Calculator (see Figure 4). This color code should help and guide users to indicate in which cells input is required and which cells calculates automatically. Cells and sheets, which are indicated green show that data input from the user is required.

Figure 4: Color code within the MobiliseYourCity Emissions Calculator

Dark grey cells are disabled ones, where no input is required. This can change according to the inputs (by filling in the tool you will notice that green cell or dark cells may change color. This is an automatic guidance to avoid wrong or missing input). Light grey cells provide further information and show the results of calculations and should not be changed. Orange cells are national default values. They are given in the scenario sheets for indication (or not depending if MYC already has defaults data for your country). In the default value sheets these are IPCC default values for energy content end emission factors. They should be adapted only if more precise AND reliable local data are available.

Completion: In the green marked cells on the left hand side in the sheet 'Get started' the user can set up the tool:

- Select the type of user: country OR city
- Type the name of your country/city; e.g. Uganda
- Type the reference year; e.g. 2016
- Select your preferred language (choose between French, English and Spanish)

Please provide the following information: Choose whether the tool is used for a country or city (drop down menu). Apply the name of the country/city, the reference year and your preferred language		Presentation of the tool
Country	example country	**Purpose of this tool:**
Reference year	2016	This tool enables calculating the greenhouse gas (GHG) emissions inventory of cities and countries as well as a BAU "business as usual" scenario and a climate scenario.
Language	English	

Figure 5: Required user input to set up the MobiliseYourCity Emissions Calculator

2.2. Sheet „1A Input Base and BAU"

Provides input data of countries/cities transport activity to calculate GHG-emissions for a specific reference year (GHG-inventory) and/or for a BAU scenario.

General information: If only the reference year should be calculated, it is sufficient to put data in the green marked cells of the reference year. In this case, the sheets "2A and 2B" are of no further importance. If in addition to the reference year, a BAU scenario should be calculated the user should put data in the green marked cells of the future years on the right hand side. For quality check purposes results from the vkt, modal split and emissions calculations are displayed on the right hand of the sheet. According to the user input the results can be distinguished between road and rail transport, different vehicle categories and fuel types.

Definition: Business as Usual (BAU)

BAU means a projection of a future year assuming no intervention is implemented and Counterfactual baseline means a projection of what would have happened in the past without the intervention, but based on historical drivers other than the mitigation action" see Compendium on GHG Baselines and Monitoring Passenger and freight transport, GIZ et al., 2018). The input data for the BAU scenario i.e. annual vkt growth rate in 2), vkt break down according to fuel type in 3.ii) and energy efficiency in 3.iii) should follow this methodology.
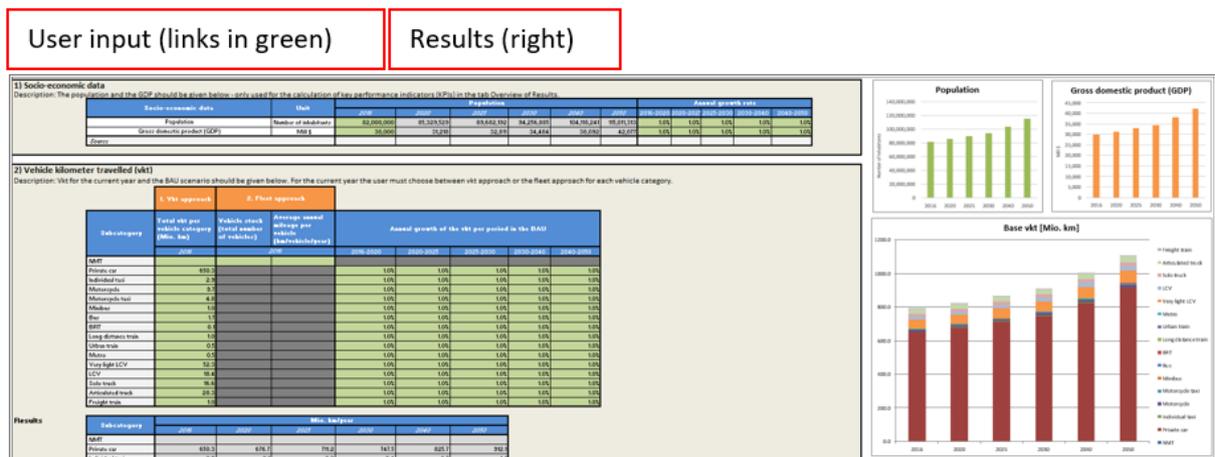
Figure 6: Overview of the upper part of sheet "1A input base and BAU"

Completion:

Step 1) Socio-economic data:

To calculate the inventory for the reference year the user has to enter data on **population and GDP (USD Billion)** (total number of inhabitants and Gross Domestic Product) in the reference year. If in addition to the inventory a Business-as-usual scenario should be calculated, the annual growth rates for both data for the time period on the right hand side have to be filled in
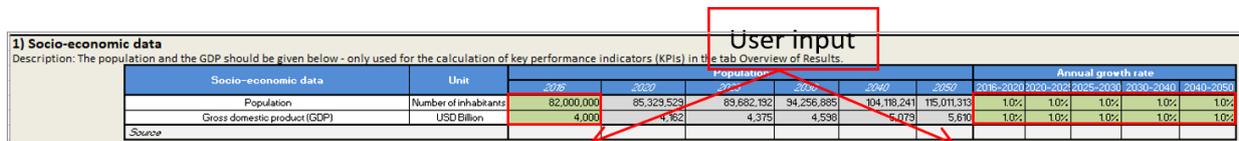

Figure 7: Socio-economic data

Side note: The number of inhabitants (Population) for the reference year has to be entered correctly in order to guarantee valid crosschecks, which are implemented in the data input cells in the next steps!

Step 2) Vehicle kilometer travelled (vkt):

The user can choose between two approaches depending on the format and type of data available concerning transport demand. In the first approach: **1. Vkt approach** where the total mileage per vehicle category can be directly given into the green cells in column C. In the second approach: **2. Fleet approach (column D & E)** both the total number of vehicles in use and the average annual mileage per vehicle category have to be entered. In both cases the user should try to reflect in the best way possible the real vkt driven within its territory (trips starting and ending in the territory but also outgoing and incoming trips).

To calculate a BAU scenario the user has to fill in data for annual growth rates for the total vehicle kilometers travelled (vkt) for the specific time period (working for the two approaches above) – see **Fehler! Verweisquelle konnte nicht gefunden werden.**.

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Figure 8: Vehicle kilometers travelled

Step 3.i) Load, occupancy rate and average trip length:

Reliable local or national data is available the occupancy rates, load factors and average trip length should be gathered for each vehicle type. If no local data is available on the right hand side and for some countries/cities, the tool provides defaults values (please contact the MYC secretariat to check if these are available for your country) for the occupancy and load factors (orange cells).. Please consider that average occupancy and average trip length must be entered to enable the tool to run calculation.

Figure 9: Occupancy, load and trip length

Step 3.ii) Vehicle kilometer travelled breakdown by fuel type:

Here vehicle kilometers (vkt) travelled by vehicle category and fuel type (diesel, gasoline, electric etc) for the reference year as well as future years (if a BAU scenario is to be calculated) should be entered If no data is available on the city level national default values from the default values on the right

hand side (in orange) can be applied (please contact the MYC secretariat to check if these are available for your country).

ℹ Please make sure that the sum of the vkt shares within a vehicle category is 100%

Figure 10: Vkt breakdown by fuel type

Step 3.iii) Average energy/fuel consumption for the reference year and energy efficiency change in the BAU scenario:

Average energy/fuel consumption for each vehicle category and fuel type (e.g. 8 l/100 km for example) should be entered in the table average energy consumption. If no data is not available on the city level, national default values (orange cells) can be applied (please contact the MYC secretariat to check if these are available for your country). For the BAU scenario, the annual energy consumption reduction (based on technological development and potentially based on policies planned in the BAU which could impact energy efficiency) for the given time period has to be estimated in the cells on the right hand side ("Annual reduction in % on the given period").

ℹ BAU scenario values: Negative values reduce the fuel/energy consumption; positive values increase the fuel/energy consumption.

Figure 11: Average energy/fuel consumption and efficiency improvements

Step 3.iv) Evolution of the CO2 content of the electricity in both scenarios

In order to address the Well-To-Wheel CO_2 emissions from electric vehicles the CO_2 content from the electricity production has to be entered separately for both road and rail (g CO_2/kWh).

ℹ It has to be mentioned, that these values apply for both the BAU-scenario as well as the climate scenario.

3.iv) Evolution of the CO2 content from the electricity production in both scenarios

Example: The GHG emissions of electric vehicles are zero when applying a TTW (tank to wheel) approach. If the WTW (well to wheel) approach is applied also the
the electricity are relevant.

Remark: The CO2 content of the electricity production from each country and may vary greatly.

Input data for the electricity mix		2016	2020	2025	2030	2040	2050
				local			
Road – Electric	g CO2/kWh	500	400	300	200	100	50
Train – Electric	g CO2/kWh	500	400	300	200	100	50
Source							

Figure 12: CO2 content from electrity production

2.3. Sheet „1B Top-Down Validation"

Validate/compare the calculated energy consumption from the MobiliseYourCity Emissions Calculator calculated inventory (bottom-up) with statistical data (top-down).

General information: The bottom-up calculated energy consumption in the reference year is compared with statistical data i.e. energy balance for countries (Top-down energy consumption). Locally these statistics may be the cumulative sales of fuels from refueling stations within the territory not be available (see Figure 6). A difference of some points of percentage is to be expected, as the two approaches rely on different data sets and data cannot be perfectly robust. Please see Compendium on GHG Baselines and Monitoring Passenger and freight transport (GIZ et al. 2018) on explanation on reasons for discrepancy.
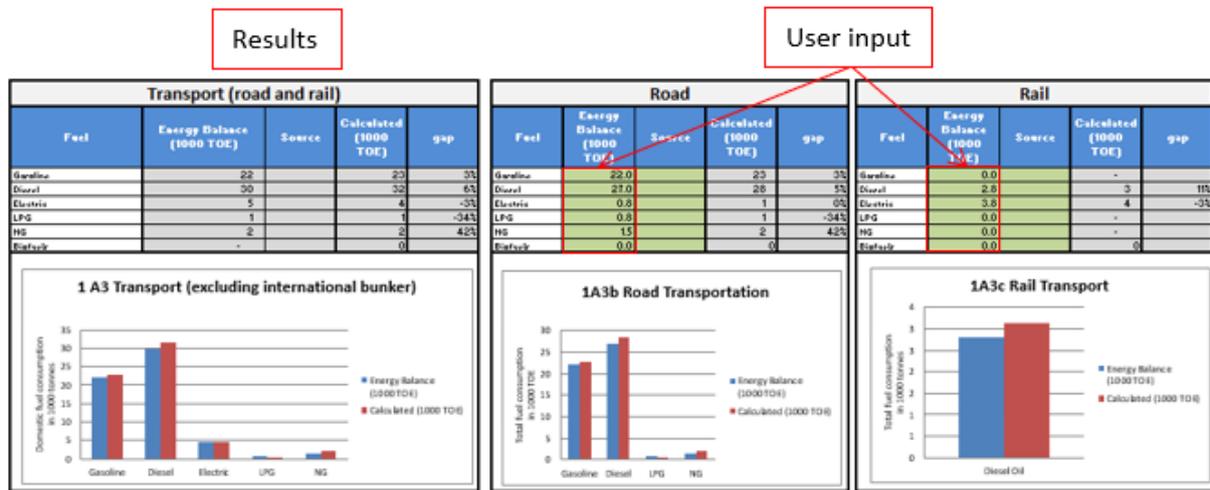
Figure 13: Bottom-up / Top-down Validation

Completion: For this validation, the user has to put in the energy/fuel consumption values for all relevant energy types for both road and rail transport (from their energy balance or statistics on fuel sales). The validation/comparison between Bottom-up and Top-down is shown in the figures below the input tables.

2.4. Sheet „2A Input Climate Scen. Pass"

Calculate a future scenario -called climate scenario) calculating the impact of bundle of mitigation actions.

General information: In the upper area of the sheet the results of the BAU scenario and the climate scenario (total vkt and GHG emissions) are shown (see Figure 14). Before any inputs are entered the results of the 2 scenarios (BAU and climate scenario) should be the same (0% reduction). By entering

inputs on emission reduction measures the impact on vkt and GHG emissions can directly be seen in the two figures.
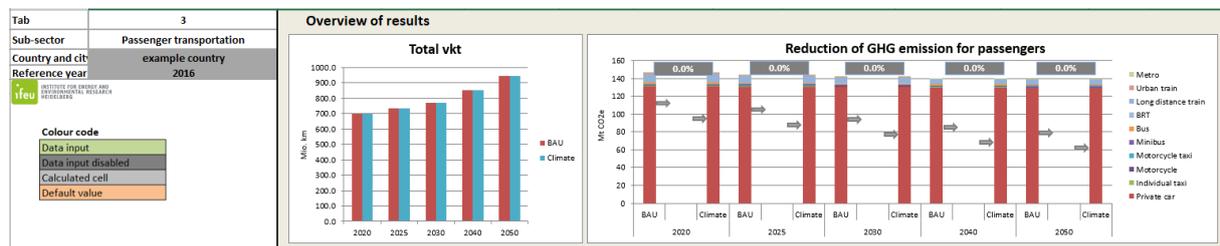
Figure 14: Results of the climate scenario in comparison to the BAU scenario – Passenger transport

There are two possible data input approaches for transport demand in this sheet. Which one the user should apply depends on the data available.

- If the future transport demand data for both the total mileage (vkt) and transport performance (pkm) can be derived from a transport model, this data can directly be put in the table in the box "With transport planning tool" sof the MYC-tool.
- If no transport model is available, the user can adjust the transport demand in a step-by-step approach in the section "Without transport planning tool" following the Avoid, Shift, Improve approach (ASI)

i It is highly recommended not mixing both methods in order to get robust results! Please choose only one approach and apply all required data only for this approach. If data available are in both formats please request a transport expert to ensure consistency.

After choosing one of these methods, you can go to step 3) improve: penetration of alternative energies

Completion:

Approach 1: With transport planning tool: First the transport performances in Mio Pkm (Person-km) and the vkt (in Mio km) from a transport model tool have to be directly put in the two green tables. The data input should be continued in section "3) Improve:"

i If users put in values, which lead to negative vkt within a vehicle category an error check pop-up menu will be shown.
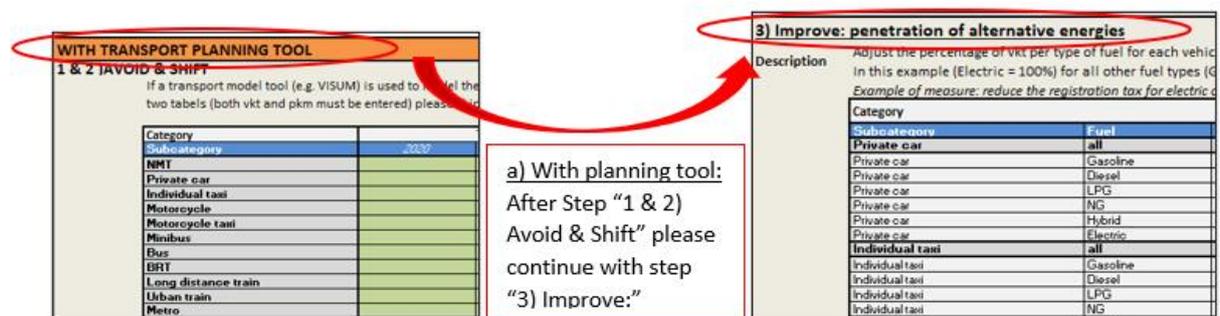
Figure 15: General approach with transport planning tool

Approach 2: Without transport planning tool: If no transport planning tool is available the avoided, shifted transport has to be calculated with a step-by-step approach in the section "Without transport planning tool". Afterwards the third section on energy efficiency has to be filled in.

Figure 16: Step-by-step approach without transport planning tool

Step 1) Avoid: Kilometers avoided for all modes of transport: In the table "Avoided motorized vkt", the percentage of the transport demand (vkt) avoided due to the implementation of mitigation actions can be entered. If traffic is not avoided by the policies planned in the climate scenario, please skip this section and go to 2) Shift

Positive values decrease the transport demand (avoided kilometers) in the climate scenario whereas negative values increase the transport demand (is not recommended for a climate scenario….). If users put in values, which lead to negative vkt within a vehicle category an error check pop-up menu will be shown.

Figure 17: Without transport planning tool step 1) Avoid

Step 2) Shift to sustainable transport modes: In this step, the modal shift can be calculated. The tables, which contain the BASE transport demand in the upper part in this section is for informational purposes only.

- If the planned measures reduce the vkt of one or more categories please enter the number of additional vkt in the corresponding green table (only public transportation is planned as a climate scenario should not increase private modes of transport). Once the number of additional kilometers is entered, please enter in the table origin mode of additional vkt the original vehicle category from where the new users come from (ex: more bus kilometers come 50% out of car user out 50% out of NMT). The area where the origin mode of transport has to be entered should turn green in the corresponding table.

ℹ If users put in values, which lead to negative transport demand within a vehicle category an error check pop-up menu will be shown.

- If the planned measures impact the occupancy rate, please enter the new occupancy rates. Similarly as above the share of trips that the new public transport users do should be attributed to the former mode of transport (ex: more people use urban train and we assume that all of them come from a buses because a corresponding bus line has been transferred)
- The planned measures can change both inputs: vehicle vkt and the number of people in these vehicles. Please consider aligning these inputs so that the transport performance (person kilometer) and modal split fit with your predictions.
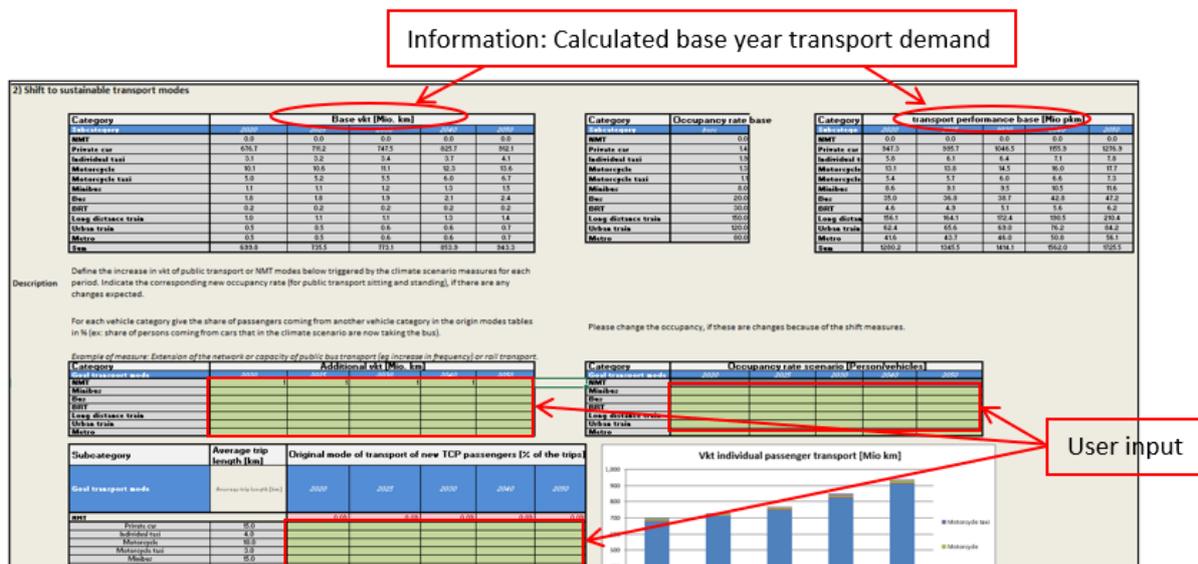
Figure 18: Without transport planning tool step 2) Shift – Overview

ℹ The input values have to be entered in % of the trips. Please make sure that the sum of a vehicle category is 100%. Please do not forget to consider induced transport.

Figure 19: Without transport planning tool step 2) Shift – Origin transport mode(s)

Results for transport demand: the results of the inputs concerning the climate scenario measures are displayed in table "Scenario vkt" and "transport performance in the scenario". These values are calculated from either the step "with transport planning tool" or the steps "without transport planning tool". No matter which approach was chosen, this transport demand values were considered for all further calculations of the energy demand and GHG-emissions in the climate scenario.

i If users have put in values, which lead to negative transport demand within a vehicle category these negative numbers will be indicated red in the table. If cells are indicated red, please check your previous data input in this sheet and make sure no cells are indicated red before you continue.

Figure 20: Results for the transport demand in the climate scenario

Step 3) Improve: penetration of alternative energies: In this step, the climate scenario's calculated transport demand (vkt) of each vehicle type can be split into different fuel types. In the calculation, the shares from the BAU scenario are shown for information. This input is necessary to calculate GHG emissions. If one energy is not in use, you can input 0 or nothing. If nothing change in comparison to the BAU, please copy the BAU value in the green table.

i The sum in each vehicle category has to be 100 %, which will be indicated green.

Figure 21: Step 3) Improve: Penetration of alternative fuels

Step 3) Improve: adjustment of fuel/energy consumption: In this last step the average fuel/energy consumption for the climate scenario can be adjusted. In the calculation, the consumption values from the BAU scenario are shown for information. This input is necessary to calculate GHG emissions. If one/several type(s) of fuel is not in use, you can input 0 or nothing. If nothing changes in comparison to the BAU, please copy the BAU value in the green table.

Figure 22: Step 3) Adjustment of fuel/energy consumption

2.5.   Sheet „2B Input Climat Scen. Freight"

Calculation of a climate scenario for freight transport showing the impact of mitigation actions.

General information: The structure of the user input and the calculation methodology for freight transport (sheet 2B) is in principal equal to the structure of the input and the calculation methodology explained for the passenger transport (see section 2.4. in this document).

Completion: For the completion of the sheet please refer to section 2.4. in this document (sheet in the tool "2A Input Climat Scen. Pass."). As mentioned before, the structure and calculation methodology for both freight and passenger transport is equal. The steps and points to pay attention described for the passenger transport can be applied for freight transport as well (sheet "2B Input Climat Scen. Freight").

2.6.   Sheet „Overview of results"

Summary and overview of the calculated results from the inventory, the BAU and the climate scenario.

General information: The sheet provides the GHG inventory see section 1) and displays the results from the BAU and climate scenarios both for passenger and freight transport (see section 2). Pay attention to the fact that you have to select the type of emission (WTW/TTW -> see below). In section 3) Key Performance Indicators (KPI´s) for the reference year and both the BAU and climate scenario are dispplayed. These numbers can be used for monitoring purposes as well as tracking progress over time.

Completion: In section 1, the user gets the option to select which scope should be used to calculate GHG emission. The first emissions scope is called Tank-To-Wheel approach (TTW), which only contains GHG emissions, from fuel combustion (so called direct emissions). The second approach, which is called Well-To-Wheel approach (WTW) contains the GHG emissions from the energy production and transport of fuel/energy in addition to the direct emissions. The first scope should be used if the results are used for inventory purposes (context of the UNFCCC). The second scope is useful if the entire impact of the transport sector wants to be studied incl. the impact of electro-mobility and electricity production.
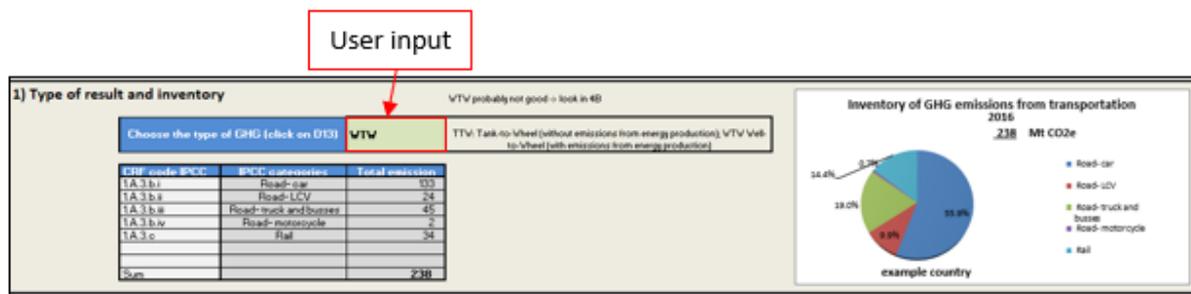
Figure 23: GHG inventory results and option to switch between the TTW and WTW approach

Annex 1: List of data needs

This document aims at giving an overview of the data required to calculate transport GHG emissions in the MYC tool.

Methodology and scope

The **scope** of the transport GHG inventory and scenario calculation should be defined at the first place: national assessment (context of an NUMP) or local (SUMP) – local can be at the city level but also the metropole. The specific geographical boundaries of the territory assessed must be clear and stay consistent during the entire process for all data inputs.

The years for which the inventory has to be made called **base year** should also be defined. Please take into account the number and quality of data available for the past years and choose a reasonably near to present date for which as many data inputs as possible are available. **The projection time should also be defined**, the tool enables assessment until 2050, but the user can choose to limit his assessment to previous years (ex: 2030).

All **data inputs** –shown through **green cells**- are mandatory to use all functionalities of the tool i.e. inventory for base year, BAU and climate scenario as well as Key performance indicators (KPI). If you do not want to use all functionalities, provide compulsory data only for the assessment you want to proceed with (ex: if you only want to do an inventory you do not have to give data for BAU or scenario). Please consider that the inventory is compulsory to calculate BAU and climate scenarios.

If the user wants to calculate a Business-as-usual (BAU) scenario (also called "do nothing scenario"), please refer to the definition in Compendium on GHG Baselines and Monitoring Passenger and freight transport, GIZ et al., 2018: "BAU means a projection of a future year assuming no intervention is implemented and Counter- factual baseline means a projection of what would have happened in the past without the intervention, but based on historical drivers other than the mitigation action."

An overview of the data required and the geographical scope at which they should be gathered is given in Fehler! Verweisquelle konnte nicht gefunden werden.. The more precise the data, the better (i.e. for a local assessment: city then national and finally regional if national is not available). Nevertheless many data inputs are usually not available at all level, so the minimum requirement for accuracy is given below depending if the tool is used by a country or a city. If no national data are available for one parameter it might be replaced by data at the regional level e.g. values for Asia. Default emission factors from IPCC are provided in the MYC tool. They can be used or replaced by better national or regional data if available.

Category/Parameter	Data required for	Sensitivity for results	Data collection recommendations for investigations on the national and city level			
			National level		**City level**	
			Scope	Data basis/ Data source	Scope	Data basis/ Data source
Socio-economic data						
1) Population - Number of inhabitants	Inventory	/	National data	National authority, Surveys	City data	City authority, Surveys
Population growth rate	BAU, Climate scenario	/	National data	National authority, assumptions	City data	City authority, assumptions
Gross domestic product (GDP) or Gross market product (GMP) for cities	Inventory	/	National data	National authority	(City data)	City Authority if data available
GDP growth rate or Gross market product (GMP) for cities	BAU, Climate scenario	/	National data	National authority, assumptions	(City data)	City authority, assumptions if data available
Transport demand						
3a) Vkt approach						
Total annual vehicle kilometers travelled per vehicle category	Inventory	+++	National data	Transport model, surveys	City data	Transport model, surveys
Annual Vkt growth rate per vehicle category	BAU, Climate scenario	+++	National data	Transport model, assumptions	City data	Transport model, assumptions
Average Vkt share by fuel type	Inventory	++	National data	Statistics, Surveys, default values	National data	Statistics, Surveys, default values
Average Vkt share by fuel type in future years	BAU, Climate scenario	++	National data	Surveys, default values	National data	Surveys, default values
3b) Fleet approach						
Vehicle stock (total number of vehicles) per vehicle category	Inventory	+++	National data	Statistics, Surveys	City data	Statistics, Surveys
Average annual mileage per vehicle category	Inventory	+++	National data	Statistics, Surveys, default values	City data	Statistics, Surveys, default values
Annual Vkt growth rate per vehicle category	BAU, Climate scenario	+++	National data	Surveys, assumptions	City data	Surveys, assumptions
Average Vkt share by fuel type	Inventory	++	National data	National authority, surveys, default values	National data	City authority, surveys, default values
Average Vkt share by fuel type in future years	BAU, Climate scenario	++	National data	Literature, assumptions	National data	Literature, assumptions
Average occupancy/load per vehicle category	Inventory, BAU, Climate scenario	++	National (or regional data)	National authority, surveys, default values	National (or regional data)	City authority, surveys, default values
Average trip length per vehicle category	Inventory, BAU, Climate scenario	++	National data	National authority, surveys, default values	National data (or regional data)	National authority, surveys, default values
Energy consumption						
Average energy consumption per	Inventory	+++	National (or regional data)	National authority, surveys, default values	National (or	National authority, surveys, default values

Table 1: List and scope of input parameters; Legend / no data; + low; ++ medium; +++ high

Data inputs are described by sheet in the next paragraphs. Emission factors are not described here as IPCC defaults are provided and it is not expected that users have better data. If this is the case, the data can be updated in Sheet "6. Default parameters"

Sheet „Input Base and BAU"

1. Socio-economic data (used for the calculation of the KPI):

■ **Population** of the defined geographical territory for base year and **annual growth rate** for following years (BAU)

■ **GDP in USD Billion** for base year and **annual growth rate** for following years (BAU)

1) Socio-economic data												
Description: The population and the GDP should be given below - only used for the calculation of key performance indicators (KPIs) in the tab Overview of Results.												
Socio-economic data	Unit	Population						Annual growth rate				
		2016	*2020*	*2025*	*2030*	*2040*	*2050*	2016-2020	2020-2025	2025-2030	2030-2040	2040-2050
Population	Number of inhabitants	82,000,000	85,329,529	89,682,192	94,256,885	104,118,241	115,011,313	1.0%	1.0%	1.0%	1.0%	1.0%
Gross domestic product (GDP)	USD Billion	4,000	4,162	4,375	4,598	5,079	5,610	1.0%	1.0%	1.0%	1.0%	1.0%
Source												

Figure 24: Socio-economic data

2. Vehicle kilometer travelled

Two approaches are possible depending on the format and type of data available concerning transport demand.

■ **Option 1: Vkt approach: total mileage within the territory per vehicle category in Mio km**

■ **Option 2: Fleet approach : total number of vehicles in use and the average annual mileage** per vehicle category within the territory. The multiplication gives the annual mileage as in Option 1 (be careful to consider all trips within the territory incl. outgoing and incoming trips)

■ **Vkt Annual growth rate in %** per period (base year-2020; 2020-2025; 2025-2030; 2030-2040; 2040-2050)

2) Vehicle kilometer travelled (vkt)								
Description: Vkt for the current year and the BAU scenario should be given below. For the current year the user must choose between vkt approach or the fleet approach for each vehicle category.								
Remark 1: The total vkt (mileage approach) or average annual mileage (fleet approach) should comply with the transport activity within the city or country territory.								
Remark 2: Definitions and a short description of every vehicle category can be found in the sheet "Sources and abbreviation".								
		1. Vkt approach	2. Fleet approach					
Subcategory	Total vkt per vehicle category (Mio. km)	Vehicle stock (total number of vehicles)	Average annual mileage per vehicle (km/vehicle/year)	Annual growth of the vkt per period in the BAU				
	2016		*2016*	2016-2020	2020-2025	2025-2030	2030-2040	2040-2050
NMT	100.0			1.0%	1.0%	1.0%	1.0%	1.0%
Private car	650.3			1.0%	1.0%	1.0%	1.0%	1.0%
Individual taxi	2.9			1.0%	1.0%	1.0%	1.0%	1.0%
Motorcycle	9.7			1.0%	1.0%	1.0%	1.0%	1.0%
Motorcycle taxi	4.8			1.0%	1.0%	1.0%	1.0%	1.0%
Minibus	1.0			1.0%	1.0%	1.0%	1.0%	1.0%
Bus	1.7			1.0%	1.0%	1.0%	1.0%	1.0%
BRT	0.1			1.0%	1.0%	1.0%	1.0%	1.0%
Long distance train	1.0			1.0%	1.0%	1.0%	1.0%	1.0%
Urban train	0.5			1.0%	1.0%	1.0%	1.0%	1.0%
Metro	0.5			1.0%	1.0%	1.0%	1.0%	1.0%
Very light LCV	52.3			1.0%	1.0%	1.0%	1.0%	1.0%
LCV	18.4			1.0%	1.0%	1.0%	1.0%	1.0%
Solo truck	16.6			1.0%	1.0%	1.0%	1.0%	1.0%
Articulated truck	28.3			1.0%	1.0%	1.0%	1.0%	1.0%
Freight train	1.0			1.0%	1.0%	1.0%	1.0%	1.0%

Figure 25: Vehicle kilometers travelled

3. Load, occupancy rate and average trip length:

■ **Occupancy rates in persons/vehicle** for the base year& the BAU (stays the same) for each passenger vehicle category (in passenger/vehicle)

■ **Average trip length in km** for the base year & the BAU (stays the same) for each passenger vehicle (in km)

■ **Load factors in tons/vehicle** for the base year & the BAU (stays the same) for each freight vehicle category

Figure 26: Occupancy, load and trip length

4. Breakdown of Vehicle kilometer travelled by fuel type

■ **Share of the vkt travelled by type of fuel in %** (diesel, gasoline, electric etc) for each vehicle category for the reference year as well as BAU. The sum should equal 100%

Figure 27: Vkt breakdown by fuel type

5. Energy/fuel consumption

■ **Average energy/fuel consumption in liter, kg or kWh/100 km** for each vehicle category and fuel type in use

■ **Annual fuel consumption rate of improvement in %** of the vehicle consumption in the BAU scenario per period (base year-2020; 2020-2025; 2025-2030; 2030-2040; 2040-2050)

3.iii) Average energy/fuel consumption for the reference year and energy efficiency change in the BAU scenario
Description: Enter the average fuel consumption for each vehicle category and energy type for the reference year (average fuel/energy consumption per vehicle per 100 km) and the annual reduction per period (negative numbers =
National default data are shown in the right table in orange - if available

Subcategory	Fuel	Average energy consumption						Unit	Annual reduction in % on the given period				
		local							local				
		2016	2020	2025	2030	2040	2050		2016-2020	2020-2025	2025-203	2030-2040	2040-2050
NMT	n.d.	0.0	0.0	0.0	0.0	0.0	0.0						
Private car	Gasoline	8.0	7.7	7.3	6.9	6.3	5.7	l/100 km	-1.0%	-1.0%	-1.0%	-1.0%	-1.0%
Private car	Diesel	6.0	5.8	5.5	5.2	4.7	4.3	l/100 km	-1.0%	-1.0%	-1.0%	-1.0%	-1.0%
Private car	LPG	5.0	4.8	4.6	4.3	3.9	3.6	l/100 km	-1.0%	-1.0%	-1.0%	-1.0%	-1.0%
Private car	NG	5.0	4.8	4.6	4.3	3.9	3.6	kg/100 km	-1.0%	-1.0%	-1.0%	-1.0%	-1.0%
Private car	Hybrid	4.0	3.8	3.7	3.5	3.1	2.8	l/100 km	-1.0%	-1.0%	-1.0%	-1.0%	-1.0%
Private car	Electric	20.0	19.2	18.3	17.4	15.7	14.2	kWh/100km	-1.0%	-1.0%	-1.0%	-1.0%	-1.0%
Individual taxi	Gasoline	9.0	8.6	8.2	7.8	7.1	6.4	l/100 km	-1.0%	-1.0%	-1.0%	-1.0%	-1.0%
Individual taxi	Diesel	7.0	6.7	6.4	6.1	5.5	5.0	l/100 km	-1.0%	-1.0%	-1.0%	-1.0%	-1.0%
Individual taxi	LPG	6.0	5.8	5.5	5.2	4.7	4.3	l/100 km	-1.0%	-1.0%	-1.0%	-1.0%	-1.0%
Individual taxi	NG	6.0	5.8	5.5	5.2	4.7	4.3	kg/100 km	-1.0%	-1.0%	-1.0%	-1.0%	-1.0%
Individual taxi	Hybrid	5.0	4.8	4.6	4.3	3.9	3.6	l/100 km	-1.0%	-1.0%	-1.0%	-1.0%	-1.0%
Individual taxi	Electric	22.0	21.1	20.1	19.1	17.3	15.6	kWh/100km	-1.0%	-1.0%	-1.0%	-1.0%	-1.0%

Figure 28: Average energy/fuel consumption and efficiency improvements

6. CO2 content of the electricity

■ **The CO2 content of electricity in g CO2/kWh** for both road and rail for the base year and projected for the given years (2020,2025,2030,2040,2050)

These data are used for all scenarios

3.iv) Evolution of the CO2 content from the electricity production in both scenarios

Example: The GHG emissions of electric vehicles are zero when applying a TTW (tank to wheel) approach. If the WTW (well to wheel) approach is applied also the
the electricity are relevant.

Remark: The CO2 content of the electricity production from each country and may vary greatly.

Input data for the electricity mix		2016	2020	2025	2030	2040	2050
		local					
Road – Electric	g CO2/kWh	500	400	300	200	100	50
Train – Electric	g CO2/kWh	500	400	300	200	100	50
Source							

Figure 29: CO2 content from electricity production

Sheet „1B Top-down-Validation"

■ **Fuel sales out of the energy balance in thousand TOE** (ton oil equivalent) for the base year and for road and rail sectors
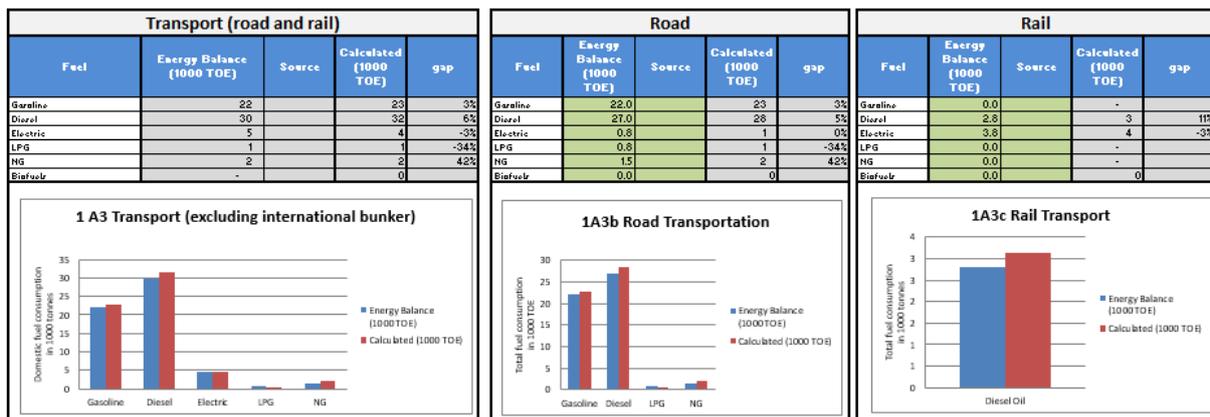
Figure 30: Bottom-up / Top-down validation

Sheet „2A Input Climat Scen. Pass"

Two approaches are possible depending on the format and type of data available concerning transport demand change in the climate scenario.

■ **Shift Option 1 (**for example if results of a transport model **are available)**

▪ **New vkt for the climate scenario in Mio km** for each vehicle category once all avoid and shift measures are implemented

▪ **New transport performance in Mio pkm** for each vehicle category once all avoid and shift measures are implemented

Figure 31: With transport planning tool step 2) Shift – overview

■ **Shift Option 2:**

▪ **Avoided annual vkt in % of BAU values** (as result of of the bundle of avoid measures)

Category	Avoided motorised vkt [%]				
Subcategory	2020	2025	2030	2040	2050
Private car					
Individual taxi					
Motorcycle					
Motorcycle taxi					
Minibus					
Bus					
BRT					
Long distance train					
Urban train					
Metro					

Figure 32: Avoided motorized vkt passenger climate scenario

▪ **Shifted vkt:**

• **Additional vehicle vkt in Mio km for the designated years 2020,2025,2030,2040,2050) for public transport modes** (ex: implementation of new bus lines)

• **New occupancy for designated years 2020,2025,2030,2040,2050 for public transport modes** (ex. decrease of bus ticket price)

Figure 33: Without transport planning tool step 2) Shift – overview

• **Share of the new trips attributed to original transport mode** (ex: of new minibus users 80% are previous car drivers and 20% motorcycle drivers

Subcategory	Average trip length [km]	Original mode of new trips [% of the trips]				
Goal transport mode	Average trip length [km]	2020	2025	2030	2040	2050
NMT						
Private car	15.0					
Individual taxi	4.0					
Motorcycle	10.0					
Motorcycle taxi	3.0					
Minibus	15.0					
Bus	20.0					
BRT	10.0					
Long distance train	100.0					
Urban train	25.0					
Metro	20.0					
Induced traffic						
Minibus			100.0%			
NMT	0.1					
Private car	15.0		80.0%			
Individual taxi	4.0					
Motorcycle	10.0		20.0%			
Motorcycle taxi	3.0					
Bus	20.0					
BRT	10.0					
Long distance train	100.0					
Urban train	25.0					
Metro	20.0					
Induced traffic						

Figure 34: Without transport planning tool step 2) Shift – Origin transport mode(s)

■ **Share of the climate scenario vkt by fuel type in % for designated years 2020,2025,2030,2040,2050**

Category			Vkt share by fuel for Climate scenario [%]				
Subcategory		Fuel type	2020	2025	2030	2040	2050
Private car		all					
Private car		Gasoline					
Private car		Diesel					
Private car		LPG					
Private car		NG					
Private car		Hybrid					
Private car		Electric					
Individual taxi		all					
Individual taxi		Gasoline					
Individual taxi		Diesel					
Individual taxi		LPG					
Individual taxi		NG					
Individual taxi		Hybrid					
Individual taxi		Electric					

Figure 35: Penetration of alternative fuels

■ **Average fuel consumption by fuel type in liter, kg or kWh/100 km for designated years 2020,2025,2030,2040,2050**

Category			Specific fuel/energy consumption for climate scenario				
Subcategory		Fuel type	2020	2025	2030	2040	2050
Private car		all					
Private car		Gasoline					
Private car		Diesel					
Private car		LPG					
Private car		NG					
Private car		Hybrid					
Private car		Electric					
Individual taxi		all					
Individual taxi		Gasoline					
Individual taxi		Diesel					
Individual taxi		LPG					
Individual taxi		NG					
Individual taxi		Hybrid					
Individual taxi		Electric					

Figure 36: Adjustment of fuel / energy consumption

Sheet „2B Input Climat Scen. Freight"

■ **Shift Option 1 (**for example if results of a transport model are available)

▪ **new vkt in the climate scenario in Mio km** for each vehicle category once all avoid and shift measures are implemented

▪ **New transport performance in Mio tkm** for each vehicle category once all avoid and shift measures are implemented

Category	Transport performance [Mio. tkm]						Category	Vehicle kilometers travelled [Mio. km]				
Subcategory	2020	2025	2030	2040	2050		Subcategory	2020	2025	2030	2040	2050
Very light LCV							Very light LCV					
LCV							LCV					
Solo truck							Solo truck					
Articulated truck							Articulated truck					
Freight train							Freight train					
Sum	0,0	0,0	0,0	0,0	0,0		Sum	0,0	0,0	0,0	0,0	0,0

Figure 37: With transport planning tool step 2) Shift – overview freight

■ Shift Option 2:

▪ **Avoided vkt in % of the BAU values** (as result of of the bundle of avoid measures)

Category	Avoided motorised vkt [%]				
Subcategory	2020	2025	2030	2040	2050
Very light LCV					
LCV					
Solo truck					
Articulated truck					
Freight train					
Sum					

Figure 38: Avoided motorized vkt for freight

▪ **Shifted vkt:**
• **Additional vehicle vkt in Mio km for the designated years 2020,2025,2030,2040,2050) for freight transport modes** (ex: implementation of new bus lines)

Category	Additional vkt [Mio. km]				
Subcategory	2020	2025	2030	2040	2050
Very light LCV					
LCV					
Solo truck					
Articulated truck					
Freight train					

Figure 39: Addition vkt in the shift climate scenario

- **New load per vehicle for designated years 2020,2025,2030,2040,2050 for** (ex. Increase of articulated truck load factor)

Category	Load per vehicle [Tons/vehicle]				
Subcategory	2020	2025	2030	2040	2050
Very light LCV					
LCV					
Solo truck					
Articulated truck					
Freight train					

Figure 40: Load per vehicle in the climate scenario

- ■ **Share of the new trips attributed to original transport mode for designated years 2020,2025,2030,2040,2050** (ex: of the freight transferred to rail 80% was previously transported by solo truck and 20% by articulated truck)

Subcategory	Original modes of the additional vkt [% of the tkm]				
	2020	2025	2030	2040	2050
Freight train	100,0%				
Very light LCV					
LCV					
Solo truck	80,0%				
Articulated truck	20,0%				

Figure 41: Original modes of the freight vkt shifted

- ■ **Share of the climate scenario vkt by fuel type in % for designated years 2020,2025,2030,2040,2050**

Category		Vkt share by fuel for Climate scenario [%]				
Subcategory	Fuel type	2020	2025	2030	2040	2050
Very light LCV	all					
Very light LCV	Gasoline					
Very light LCV	Diesel					
Very light LCV	Electric					
LCV	all					
LCV	Gasoline					
LCV	Diesel					
LCV	LPG					
LCV	NG					
LCV	Electric					

Figure 42: Penetration of alternative fuels for freight climate scenario

- ■ **Average fuel consumption by fuel type in liter, kg or kWh/100 km for designated years 2020,2025,2030,2040,2050**

Category		Specific fuel/energy consumption for climate scenario				
Subcategory	Fuel type	2020	2025	2030	2040	2050
Very light LCV	all					
Very light LCV	Gasoline					
Very light LCV	Diesel					
Very light LCV	Electric					
LCV	all					
LCV	Gasoline					
LCV	Diesel					
LCV	LPG					
LCV	NG					
LCV	Electric					

Figure 43: Average fuel consumption of freight vehicle categories

Annex 2: Implementation of default values

Background

The MobiliseYourCity Emissions Calculator aims to help countries, regions and cities in developing counties to calculate transport GHG emission inventories, a Business-as-usual -BAU- scenario for future years up to 2050 and quantify potential GHG emission reductions from mitigation measures. For these calculations, a certain set of input data is required. However, the required input data are often not available in developing countries and can only be derived with great effort (e.g. surveys, vehicle counts). In order to enable users to calculate results despite the lack of local data, it would be helpful to implement regional, country or - best case - city specific pre-default values within the MYC-tool. However the current defaults available within the tool are European ones, which are very often not representative for developing countries.

This paper gives an overview of different approaches as well as first potential data sources for the implementation of default values for the MYC-tool. Furthermore, the paper provides good practice recommendations and possible first steps for an implementation process.

Assessment of important input parameters

In a first step, the input parameters required by the MYC-tool are listed and assessed in terms of sensitivity and relevance for the inventory and scenario calculation results (see ==Fehler! Verweisquelle konnte nicht gefunden werden.==). The assessment shows that most of the transport demand parameters are very sensitive whereas e.g. emissions parameters are less sensitive. One important point, linked with the sensitivity of the parameters when applying input data, is the geographical scope of the investigation. In order to get representative results for the investigated countries or cities, it is important that the data quality for the more sensitive parameters is as accurate as possible. Hence, it has to be assessed for which parameters local specific sensitive parameters (e.g. population growth rate, number of vehicles) must be applied and for which parameters national (or worst case regional e.g. Asia, Africa) less sensitive data (e.g. fuel specific GHG-emission values, average energy consumption) can be used.

==Fehler! Verweisquelle konnte nicht gefunden werden.== shows ifeu´s good practice recommendations on the minimum required geographical scope for which input parameters should be provided based on their type and their sensitivity. Of course if no data are available e.g. on city level for vehicle occupancy, it is always possible to apply national or regional defaults. But this may have a quite negative impact on results accuracy. In case reliable data are available at different levels, the most specific scope must be chosen.

Category/Parameter	Data required for	Sensitivity for results	Data collection recommendations for investigations on the national and city level			
			National level		City level	
			Scope	Data basis/ Data source	Scope	Data basis/ Data source
Socio-economic data						
1) Population - Number of inhabitants	Inventory	/	National data	National authority, Surveys	City data	City authority, Surveys
1.1) Population growth rate	BAU, Climate scenario	/	National data	National authority, assumptions	City data	City authority, assumptions
2) Gross domestic product (GDP) or Gross market product (GMP) for cities	Inventory	/	National data	National authority	(City data)	City Authority if data available
2.1) GDP growth rate or Gross market product (GMP) for cities	BAU, Climate scenario	/	National data	National authority, assumptions	(City data)	City authority, assumptions if data available
Transport demand						
3a) Vkt approach						
3a.1) Total vehicle kilometers travelled per vehicle category	Inventory	+++	National data	Transport model, surveys	City data	Transport model, surveys
3a.1.1) Vkt growth rate per vehicle category	BAU, Climate scenario	+++	National data	Transport model, assumptions	City data	Transport model, assumptions
3a.2) Vkt share by vehicle size	Inventory	+	National data	Statistics, Surveys, default values	National data	Statistics, Surveys, default values
3a.2.1) Vkt share by vehicle size in future years	BAU, Climate scenario	+	National data	Surveys, default values	National data	Surveys, default values
3a.3) Vkt share by fuel type	Inventory	++	National data	Statistics, Surveys, default values	National data	Statistics, Surveys, default values
3a.3.1) Vkt share by fuel type in future years	BAU, Climate scenario	++	National data	Surveys, default values	National data	Surveys, default values
3b) Fleet approach						
3b.1) Vehicle stock (total number of vehicles) per vehicle category	Inventory	+++	National data	Statistics, Surveys	City data	Statistics, Surveys
3b.1.1) Vehicle stock per vehicle category in future years	BAU, Climate scenario	+++	National data	National authority, assumptions	City data	City authority, assumptions
3b.2) Vehicle stock by vehicle size	Inventory	+	National data	Statistics, Surveys, default values	National data	Statistics, Surveys, default values
3b.2.1) Vehicle stock by vehicle size in future years	BAU, Climate scenario	+	National data	Literature, assumptions	National data	Literature, assumptions
3b.3) Vehicle stock shares by fuel types	Inventory	++	National data	Statistics, Surveys, default values	National data	Statistics, Surveys, default values
3b.3.1) Vehicle stock shares by fuel types in future years	BAU, Climate scenario	++	National data	Literature, assumptions	National data	Literature, assumptions
3b.4) Average annual mileage per vehicle category	Inventory	+++	National data	Statistics, Surveys, default values	City data	Statistics, Surveys, default values
3b.4.1) Average annual mileage per vehicle category in future years	BAU, Climate scenario	+++	National data	Surveys, assumptions	City data	Surveys, assumptions
3b.5) Average annual mileage	Inventory	+	National	Statistics,	National	Statistics,

by vehicle size			data	Surveys, default values	data	Surveys, default values
3b.5.1) Average annual mileage by vehicle size in future years	BAU, Climate scenario	+	National data	Literature, assumptions	National data	Literature, assumptions
3b.6) Average annual mileage by fuel type	Inventory	++	National data	National authority, surveys, default values	National data	City authority, surveys, default values
3b.6.1) Average annual mileage by fuel type in future years	BAU, Climate scenario	++	National data	Literature, assumptions	National data	Literature, assumptions
4) Average occupancy/load per vehicle category	Inventory, BAU, Climate scenario	++	National (or regional data)	National authority, surveys, default values	National (or regional data)	City authority, surveys, default values
5) Average trip length per vehicle category	Inventory, BAU, Climate scenario	++	National data	National authority, surveys, default values	City data	National authority, surveys, default values
Energy consumption						
6) Average energy consumption per vehicle category and energy type	Inventory	+++	National (or regional data)	National authority, surveys, default values	National (or regional data)	National authority, surveys, default values
6.1) Annual change in average energy consumption in future years	BAU, Climate scenario	+++	National (or regional data)	Literature, assumptions	National (or regional data)	Literature, assumptions
Emissions/Pollutants						
7) Specific emission factor of electricity production	Inventory	++	National data	National authority, Literature, default values	National data	National authority, Literature, default values
7.1) Specific emission factor of electricity production in future years	BAU, Climate scenario	++	National data	National authority, assumptions	National data	National authority, assumptions
8) Share of biofuels (based on the energy content)	Inventory	++	National data	National authority, Literature, default values	National data	National authority, Literature, default values
8.1) Share of biofuels in future years	BAU, Climate scenario	++	National data	National authority, assumptions	National data	National authority, assumptions
9) Fuel specific GHG-emission values	Inventory	+	National (or regional data) or IPCC defaults	National authority, Literature, default values	National (or regional data) or IPCC defaults	National authority, Literature, default values
9.1) Fuel specific GHG-emission values in future years	BAU, Climate scenario	+	National (or regional data) or IPCC defaults	National authority, default values, assumptions	National (or regional data) or IPCC defaults	National authority, default values, assumptions
10) Further pollutants specific emission factors (e.g. NOx, PM)	Inventory	+	National (or regional data) or IPCC defaults	National authority, Literature, default values	National (or regional data) or IPCC defaults	National authority, Literature, default values
10.1) Further pollutants specific emission factors (e.g. NOx, PM) in future years	BAU, Climate scenario	+	National (or regional data) or IPCC de-	National authority, default values, assumptions	National (or regional data) or IPCC de-	National authority, default values, assumptions

			faults		faults	

Table 2: Assessment of scopes for input parameters; Legend: / no data; + low; ++ medium; +++ high

Potential data sources and data availability of default values

In order to check the availability of such default input parameters five international and renowned tools or data bank were investigated: Curb tool, TEEMP, ForFits, Global Calculator, Transport Data Bank. This list is not exhaustive but helps getting a feeling on global default data availability. Most of the assessed tools were developed by development banks (e.g. CURB-tool developed by The World Bank) or global initiatives (e.g. TEEMP-Tool developed by the Clean Air Asia Initiative). The overview of this research is given in **Fehler! Verweisquelle konnte nicht gefunden werden.**. The green marked cells indicate that default values are available. The geographical scope at which these are available is described in **Fehler! Verweisquelle konnte nicht gefunden werden.**. The last column on the right gives a global note on the availability of the input parameter among the five tools.

The more precise the data should be, the more effort will have to be invested in data search i.e. literature, local data bank etc..

Category/Parameter	Tool					Data availability in the tools
	CURB	**TEEMP**	**ForFits**	**Global Calculator**	**Transport Data Bank Model**	
Population						
Population growth rate				✔	✔	+
Transport demand						
Number of vehicles per category			✔			+
Average Mileage per vehicle category per year		✔ in %		✔ in %	✔	++
Mileage growth rate per vehicle category					✔	+
Occupancy per vehicle category	✔	✔	✔	✔	✔	+++
Capacity per vehicle category						
Mileage share per vehicle category and fuel type	✔			✔		+
Energy consumption						
Average energy consumption per vehicle category and fuel type	✔	✔	✔			++
Efficiency improvement per vehicle category and fuel type				✔		+
Emissions						
Specific emission factor of electricity production		✔		✔		+
Improvement of specific emission factor of electricity production				✔		+
Fuel specific GHG-emission values				✔		+
Improvement of fuel specific GHG-emission values						
Further emission factors						

Table 3: Default data availability of transport tools; Legend: + low; ++ medium; +++ high; - empty: no data avilable

Parameter	Effort for data collection		
	low	medium	high
Population	🟩		
Population growth rate	🟩		
Mileage			
Number of vehicles per category			🟥
Average Mileage per vehicle category per year		🟧	
Mileage growth rate per vehicle category			🟥
Occupancy per vehicle category	🟩		
Capacity per vehicle category			🟥
Mileage share per vehicle category and fuel type		🟧	
Energy			
Average energy consumption per vehicle category and fuel type	🟩		
Efficiency improvement per vehicle category and fuel type			🟥
Emissions			
Specific emission factor of electricity production		🟧	
Improvement of emission factor of electricity production		🟧	
Fuel specific GHG-emission values			🟥
Improvement of fuel specific GHG-emission values			🟥
XX-emissions factors		🟧	

Table 4: Corresponding effort for data collection

The default values in the analyzed tools are available at different geographical scopes (see **Fehler! Verweisquelle konnte nicht gefunden werden.**). CURB provides mostly regional values, while ForFits provides national values and Global calculator city specific values. Figure 1 shows on a map the geographical scopes at which data are available in developing countries. The geographical scope of default values differs from continent to continent:

- in South America: city level
- in Asia: national level
- in Africa: regional level (South-, Central-, North- and West Africa)

	Tool				
	CURB	**TEEMP**	**ForFits**	**Global Calculator**	**Transport Data Bank Model**
Classification of available default values	mostly regional data	some regional data	national data	city data	national data

*Table 5: Default data classification of the analyzed tools*
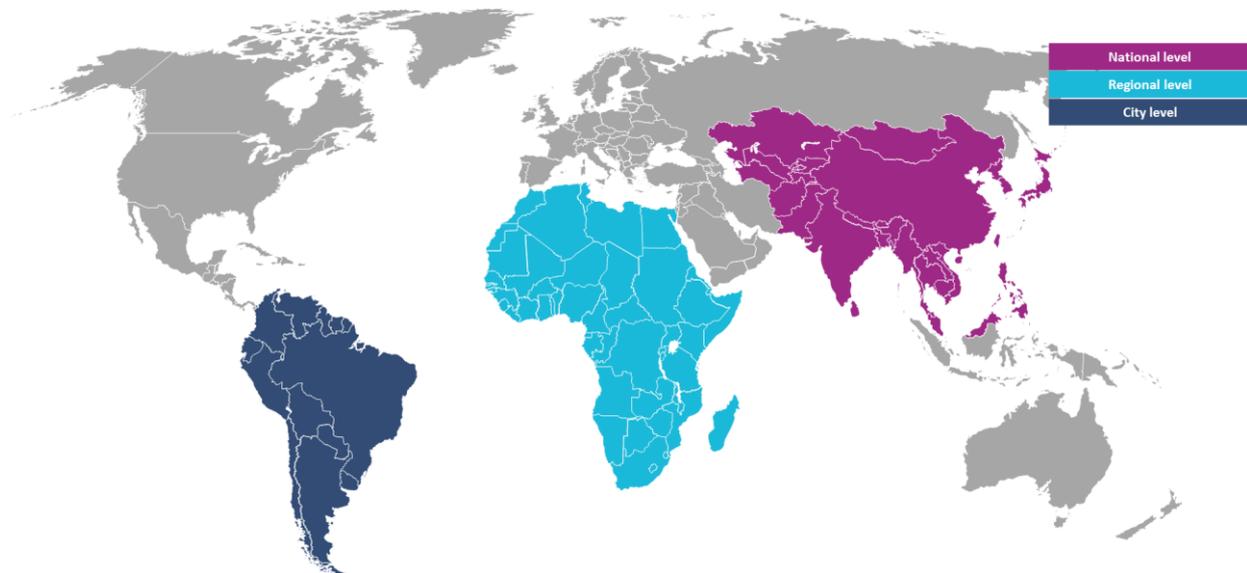
Figure 44: Classification of default values in the investigated tools

In conclusion within the investigated tools there is no standard classification pattern available, which could be applied for the implementation of default values for the MYC-tool.

Ifeu recommendations on default values collection

In order to keep the effort small as a **first step**, ifeu´s recommends **collecting and verifying the robustness of the default parameters that can be found in the above citied sources** at the different scopes. Additional important sources may be suggested by the partners.

Ifeu suggests working **first at the regional level** i.e. continent wide as a minimum: Asia, Africa, South America (aggregated city data would need to be used as national defaults). A finer scope may be of relevance if data are available and show important differences e.g. North and South Africa. The exact classification is to be assessed.

In a **second and more advanced step**, **detailed values for sub-regions and for more countries can be searched for**. This would require **investigating further potential data sources** like for example open databases (e.g. UITP - Mobility in Cities Database), literature from international projects (e.g. GIZ, AFD, MYC, international consultants) and research institutes (e.g. IGES, ITDP), typical city or county authorities (e.g. vehicle registry, ministry of transport, local transport authority).

An **important point is also the update of data**, in a sector where input parameters vary greatly with time. It is thus recommended to **plan the update of defaults values for some sensitive parameters such as the ones concerning transport demand.** In order to generate this database, it could be a good opportunity to integrate results of past and future GIZ-, AFD- and MYC-projects into this database, as soon as they are available and verified.

Technical implementation

Fehler! Verweisquelle konnte nicht gefunden werden. shows three main options available in order to provide the default values for users of the MobiliseYourCity Emissions Calculator. One approach is to implement all default values directly within the MYC-tool in the same way as the CURB tool. How-

ever, if there are many data implemented within the tool it may lead to slow operational speed. An-other approach is based on a server, where the default values could be stored in a separate databank on the internet, which automatically could be downloaded within the MYC-tool (e.g. via Java-script). The main benefit of this approach would be that this databank could be updated continuously and the operational speed, with a fast internet connection given, should be high. On the other hand, it is estimated to be more expensive and with the need to have a reliable internet connection, the data would not be directly integrated into the system.

Ifeu´s recommendation would be another approach (see **Fehler! Verweisquelle konnte nicht gefunden werden.**, indicated green), which would be a mix between the two approaches mentioned before. Users could download and locally store the most recent data file(s) for each region or country (as well as the latest version of the MYC-tool) in a separate file from an online server (e.g. MYC website). In a next step, the MYC-tool could implement the default values automatically from this file(s) (e.g. via Excel macro). This approach is used in the COPERT-tool for example. The benefits of this approach are to further improve operational speeds due to reduced memory capacity needs and enabling an easy update process of the default value data bank.

Ap-proach	Default data integration method	Example tools	Operational speed	Up-to-date data	Complexi-ty for user	System integration	Costs
Local	Within the MYC-tool	CURB	+	+	+	+++	+
Local/ Server based	Separately download file(s)	COPERT	+++	++	++	++	++
Server based	Automatically downloaded from Databank		++	+++	+	+	++

Table 6: Assessment of different implementation approaches; Legend: + low; ++ medium; +++ high