

C. ForFITS: Excel interface

General information

The user interface of the Vensim model is an Excel file that organized in different worksheets. These worksheets contain the necessary inputs to run the ForFITS model.

The tabs (in red) and related worksheets that require the user to fill-in data are:

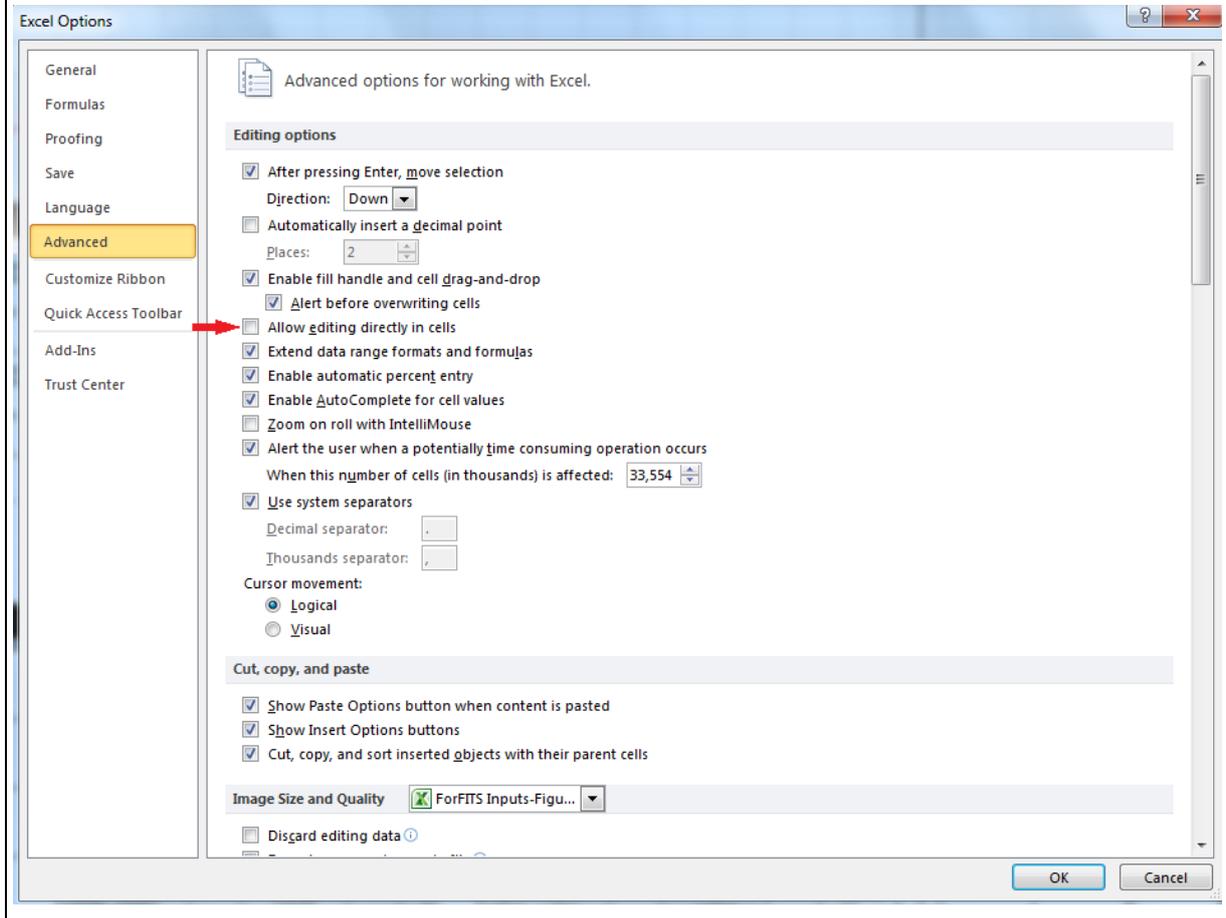
- "Socio-economic data": inputs on macroeconomic and demographic data, such as GDP and population, which are needed for projections over time.
- "Modelling switches": definition of the time period in analyse, as well as the powertrain selection procedure for the forecasted new vehicle registrations.
- "User inputs (BASE Y)": characteristics of the transport system in the base year including several characteristics of the vehicle fleet.
- "Transport system (over time)": data on the evolution of the transport system over time. This concerns mainly indexes that determine characteristics of the passenger transport system and — for freight — inputs about the economic structure, such as the type of goods in the economy as well as characteristics of their movement.
- "User inputs (over time)": inputs that enable the allocation of the transport activity or the fuel characteristics (e.g. emission factors per energy unit that lead to the CO₂ emitted by different fuel blends) over time.
- "Pwtrn potential": technical data on the performance of the vehicles and the powertrain ratios that distinguish fuel consumption in the different technologies.
- "Pwtrn shares": inputs on the technological variations in the projected new vehicle registrations: applicable for exogenous powertrain selection.
- "Pwtrn availability": data on the availability of each technology over time: applicable for endogenous powertrain selection.
- "Cost inputs by pwtrn": inputs over time on the purchase vehicle cost per technology.
- "Other costs": air vehicle costs as well as crew costs required over time.
- "Demand generation parameters": technical inputs such as parameters that determine the S-curves generated by transport demand as a function of GDP per capita and elasticities of the cost of driving on the transport activity.

The second worksheet, "Structure", contains information concerning the type of vehicles corresponding, by default, to the vehicle classes A to F in each mode and service, as well as key data used to characterize them. The sheet also contains information on the modes and vehicle classes that are considered as part of the "passenger transport driving modes" (personal vehicles, public transport and air) and the "large-freight submodes" (medium-duty trucks, heavy-duty trucks, inland navigation, short-sea shipping, maritime freight transport, rail and air freight).

The first excel sheet, named "Table of contents" summarizes the required inputs: this sheet is linked to all the input tables. Direct access to these tables (by a double click on the heading) is possible if the possibility to edit Excel cells is turned off (see Box C.1 for more information on this).

The user should ensure that the option File > Options > Advanced > Allow editing directly in cells is not selected (Figure C.1). Thus, double-clicking on any heading listed in the table of contents will automatically take the user to the corresponding table.

Figure C.1 Table of contents – Do not allow editing directly in cells



Detailed description

Some inputs (such as on the number of vehicles) are absolute requirements for characterizing the models. Others can be left unchanged: these rely on default data already included in the file.

The ForFITS Inputs Excel file contains all inputs required for the ForFITS model to function properly.

Worksheet Structure

Each of the worksheets identified by a red tab in the Excel file is divided in two sections. One section, consistently located on the right of the worksheet (e.g. in the "Socio-economic data" and in the "User inputs (BASE Y)" sheets) allows the user to store several datasets ("database section"). The other section (consistently located on the left) transfers selected input tables in "active tables", i.e. those that transfer information to the Vensim file ("selection section").

This structure aims to facilitate the use of different data sets, stored in the "database section" and activated in the "selection section" (without the need retype or re-enter each time) and facilitate the evaluation of combinations of inputs in different scenarios.

Minimum data requirements

The tables located in the "database section" of the Excel worksheets are colour-coded by cells. Table C.1 **Error! Reference source not found.** summarizes the information corresponding to the colour-code.

Table C.1 Colour coding used in the ForFITS Excel file

Colour	Meaning
Any text colour	Active data, transferred to the Vensim file.
Any text colour	Data calculated using inputs that are readily available in the file (e.g. historical inputs or information on the base year and the last available year). These cannot be changed.
Any text colour	Data calculated using inputs that are readily available, i.e. from information on both the base year and projections: normally concerns information tables calculated on the basis of indexes that characterize the inputs of the projection period.
Any text colour	Minimum data requirement for the set of input tables. This is typically used: (a) in the leftmost table of the "database section" of the worksheet, indicating that at least one table in the "database section" of the worksheets requires inputs; and (b) in the selection tables, indicating that the transfer of data from the "database section" of the worksheet requires the selection of at least one relevant dataset in the selection table.
Any text colour	These cells should be used when the user cannot disaggregate data to the level represented by cells without a coloured background.
Any text colour	Cells corresponding to the minimum data requirements in tables located beyond the leftmost table in the "database" section of the worksheet. This indicates that there should be more than one table of inputs (optional); the minimum data requirements remain valid.
Any text colour	Data concerning inputs beyond the minimum data requirements.
Any text colour	These cells are used when the information can be disaggregated to the level represented by each cell.

<i>Colour</i>	<i>Meaning</i>
Any text colour	Cells of the "Pwtrn shares" and "Pwtrn availability" sheets contain information on technologies that are currently and easily available (and, therefore, most likely to need non-zero inputs in the base year and in the future, unless the user deliberately chooses to exclude a/or certain technology/ies).
Any text colour	Cells of the "Pwtrn shares" and "Pwtrn availability" sheets contain information on technologies that can (or are likely to) be available in the forthcoming years (and, therefore, most likely to need non-zero inputs in times representing future projections: there is a deliberate choice to exclude a certain technology).
Any text colour	Cells contain technical inputs, unlikely to require changes (unless the user acquires sufficient experience to explore more technical aspects of the model).
	Not applicable. No input required.
	Used for placeholders needed to guarantee coherent structures in the tables (e.g. to show all modes, even if data are needed only for a selection of them).
	Placeholder. No input needed.

Minimum data requirements correspond to the information contained in the (which?) green cells. If more detailed information is available (e.g. on more than a single vehicle class), the (more detailed) inputs entered in white cells (corresponding to transport vehicles with more detailed characteristics, as explained in the "Structure" sheet) replace or complement and/or replace the minimum data requirements.

The second ForFITS Excel sheet, "Structure", combines information on the minimum data requirements and the characteristics of the inputs taken into account for the information considered when entering the default data in the file. The minimum data requirements shown in the "Structure" sheet are linked to the information required in tables containing passenger and freight transport services, as well as all modes and vehicle classes, in a specific year. Similar tables are located in the "User inputs (BASE Y)" sheet. In "User inputs (BASE Y)", the tables also consider an AREA dimension, allowing users to differentiate (if sufficient data are available) between different area types.

Minimum requirements may concern general information, historical inputs or projections.

General information

Minimum requirements on general information are needed for:

- initial and final projection times (located in the "Modelling switches" sheet).
- the characterization of each area (urban, non-urban or, if it includes both urban and non-urban areas, non-specified) (top of the "Transport system (over time)" sheet).
- the selection of the powertrain technology choice switch (needed to determine if the powertrain shares in new vehicle registrations over time are exogenous or endogenous ("Modelling switches" sheet).
- in case of endogenous powertrain selection, the discount rate ("Modelling switches" sheet).
- in case of exogenous powertrain selection, the powertrain shares ("Pwtrn shares" sheet).

Historical inputs

Historical inputs are required for:

- socio-economic variables (top of the "Socio-economic data" sheet).
- vehicle stock, their average travel and loads, their average fuel consumption, and the powertrain shares ("User inputs (BASE Y)" sheet).
 - new vehicle registrations, the related powertrain shares average fuel consumption¹.
- for freight transport, the shares of tonnes lifted by goods type (if this information is unavailable, the shares need be to set entirely to "other").

Projections

Absolutely essential data concerns:

- the evolution of socio-economic variables such as GDP and population over time (bottom of the "Socio-economic data" sheet).
- the fuel price over time (i.e. the fuel cost) (located in the "User inputs (over time)" sheet).
- in world regions with high shares of three wheelers, the evolution of the vehicle shares between two and three wheelers ("User inputs (over time)" sheet).
- the evolution of the pkm shares in public transport modes for each area, needed to evaluate modal changes within public transport modes (e.g. due to the construction of urban rail infrastructures and replacing buses) ("User inputs (over time)" sheet).
- the modal shares of light road freight vehicles (i.e. two wheelers, three wheelers and light commercial vehicles), indicating structural changes (light commercial vehicle are normally the majority, but this is not always the case, especially in low-income countries with a high share of two wheelers) ("User inputs (over time)" sheet).
- the evolution of the network extension (average distance travelled by each unit volume transported) for pipelines ("User inputs (over time)" sheet).

"Pwtrn shares" and "Pwtrn availability" sheets

Given the large size of the table, the "database section" is located below the "selection section" in each set of inputs included in the "Pwtrn shares" and "Pwtrn availability" sheets (see Figure C.17 for details on the location of the "database section" and the "selection section"). A number of tables, located in the "selection section", are needed to determine which information is actually transferred to the Vensim file. The active tables are located on the right of the "selection section" and they refer to the base year (rightmost set of tables) and the projections.

Given the special nature of the data in these sheets, the minimum requirements should be intended as the portions of the table characterized by the actual presence of vehicles. This is where data inputs on the powertrain shares (or the powertrain availability) are necessary.

Purple cells identify inputs which may needed when data in in other Excel sheets are filled in taking into account the minimum requirements.

¹ This is the case for new registrations taking place in the base year, 5 years earlier than the base year, and 10 years earlier ("User inputs (BASE Y)" sheet). The new registrations in the years between the base year, base year -5 and base year -10 are obtained in Vensim by means of linear interpolations. For this reason, good practice would enter information that does not represent a specific year, but rather an average of the three (or five) years around the input point.

Green cells are used only for the headings and the time associated with each input table to reflect that inputs are a requirement for the base year. In addition:

- Base year values are actually deduced from other input data (i.e. those on vehicles and powertrain shares entered in the "User inputs (BASE Y)" sheet.
- If data are not available for any other year, the base-year value is used for the entire projection period. Otherwise, values are calculated by linear interpolation.
- If inputs are available for a time period between the base and final years (and no inputs for the final year), the final year is again set, by default, as the base year.

"Cost inputs by pwtrn" sheet

As in the "Pwtrn shares" and "Pwtrn availability" sheets, the "database section" of the "Cost inputs by pwtrn" is located below the "selection section". Given that the endogenous technology choice requires the characterization of all technologies, all inputs are necessary.

The default data concerning powertrain costs in this view are estimated on the basis of an extensive literature review and statistical analyses. They are, therefore, considered, in this document, as default values that may remain unchanged (see the section on the characterization of inputs by category and Table C.2).

Orange cells contain technical inputs, unlikely to require changes (unless the user acquires sufficient experience to explore more technical aspects of the model). An important exception is the introduction of differentiated taxation schemes that impact on specific vehicle technologies. In this case, the estimates on vehicle powertrain technology costs should indeed be changed to reflect the final vehicle price, after tax.

Characterization of inputs by category

The "Table of contents" sheet contains a layout of the inputs in order from left to right, starting (top left) with the most essential ones (i.e. those that require substantial user action) and ending (bottom right) with those that are unlikely to require changes (i.e. default inputs), unless the user acquires sufficient experience to explore the response of the model with different structural characteristics.

The inputs listed in the "Table of contents" sheet are also reproduced in Table C.2. In addition to the information available in the Excel sheet, this section links each table listed with a "category" detailing the importance of user involvement in the definition of the data entered into the model. Such categories include:

- | | |
|---|--|
| M | Data absolutely required (corresponding to the minimum data requirements mentioned earlier) |
| A | Inputs expected to be introduced by the user. The current value in the ForFITS Inputs file is for guidance only. This category includes policy inputs that allow exploring different scenarios. Such cases are identified by a specific indication in Table C.2. |
| B | Input containing a (often technical) default value that may remain unchanged, depending on data availability. Defaults are set on the basis of research activities involving literature reviews and statistical analyses (further information on this is provided in the section of the ForFITS manual dealing with the explanation of the views). |

- C Changes to these inputs would likely result in modifications to the structural characteristics of the model. Unless the user acquires sufficient experience, modification of these inputs is HIGHLY not recommended.

Table C.2 Inputs listed in the "Table of contents" tab, with characterization by input category

<i>Item</i>	<i>Category</i>
Time period analysed	
Initial and final projection times: start and end years of the model run	M
Initial conditions	
Vehicle stock in the base year	
Number of active vehicles by area, service, mode and vehicle class	M
Number of active vehicles by technology disaggregated by powertrain shares in each vehicle class	M
Annual travel per vehicle by area, service, mode and vehicle class	M
Vehicle load by area, service, mode and vehicle class	M
Vehicle fuel consumption by area, service, mode and vehicle class	M
Powertrain ratios in each service and mode to split the vehicle fuel consumption by technology	C
New vehicle registrations in the base year, at five years and ten years before the base year	
Number of new vehicles registered by area, service, mode and vehicle class	M
Powertrain shares in each vehicle class to disaggregate the number of new vehicles registered by technology	M
Fuel consumption of the new vehicles registered by area, service, mode and vehicle class	M
Powertrain ratios in each service and mode to split the fuel consumption of the new vehicles registered by technology	C
Macroeconomic and demographic parameters: GDP and population in the base year	M
Crew costs per day by mode and service in the base year	B
Economic and demographic inputs (projections)	
Since these are main drivers in the model that build up transport demand, evolution over time of GDP and population in comparison to the base year value, these must be introduced through an index	M
Transport system characteristics	
Passenger transport system	
Characterization of each area as urban, non-urban or non-specified	M
Passenger transport system index by area: The value in the base year is calculated automatically but the evolution over time must be specified	A (policy input)
Environmental culture index by area in the base year and its evolution over time	A (policy input)
Freight transport system – Constant parameters	
Haul length by transport distance and large freight submode	B

<i>Item</i>	<i>Category</i>
Vehicle capacity ratios by vehicle class and large freight submode	B
Load factor ratios by vehicle class and large freight submode	B
Hauls per vehicle ratios by vehicle class and large freight submode	B
Freight transport system – Base year	
Shares of tonnes lifted by large-freight submode, area and good type	M
Shares of tonnes lifted by transport distance (SHORT, MEDIUM, LARGE, VERY LARGE)	
Shares of tonnes lifted in SHORT or MEDIUM distances by large-freight submode, area and good type	A
Shares of tonnes lifted in SHORT distances in total tonnes lifted in SHORT plus MEDIUM distances by large-freight submode and area	A
Shares of tonnes lifted in VERY LARGE distances in total tonnes lifted in LARGE plus VERY LARGE distances by large-freight submode and area	A
Shares of tonnes lifted by transport zone for each area and transport distance	A
Freight transport system – Over time	
Evolution of the shares of tonnes lifted by transport zone for each area	A (policy input)
Evolution of the shares of tonnes lifted by haul distance for each transport zone and good type	A (policy input)
Evolution of the shares of tonnes lifted by good type for each area and transport zone	A (policy input)
Evolution of the shares of tonnes lifted by large-freight submode for each area, transport zone and transport distance	A (policy input)
Prices and taxes (projections)	
Fuel price (before taxes) by service and fuel blend in the base year as well as over time	M
Fuel taxation by service and fuel blend in the base year as well as over time	M (policy input)
Road pricing by area, service and mode in the base year as well as over time	M (policy input)
Fuel characteristics (projections)	
Evolution of the emissions factors (Well-to-tank and Tank-to-wheel) compared to the base year value by fuel blend	A (policy input)
Fuel consumption (projections)	
Index of performance over time by service and mode (excluding AIR, NMT and PIPELINES)	A (policy input)
Ratios by technology over time with respect to GASOLINE PI ICE for each service and mode (excluding AIR, NMT and PIPELINES), as well as the evolution of fuel consumption per km for GASOLINE PI ICE vehicles and the percentage of electric driving in hybrid plug-in vehicles	B

<i>Item</i>	<i>Category</i>
Evolution of the fuel consumption per km in AIR transport by service and vehicle class	A (policy input)
Evolution of the energy consumption per km in PIPELINES by area and class	A (policy input)
Technology choice (projections)	
Powertrain technology choice switch	
Powertrain selection (as exogenous or endogenous), for the new vehicle registrations over time (projections)	M
Discount rate applied by the logit model	M (only with endogenous powertrain selection)
Powertrain shares in the forecasted new vehicle registrations over time for each service, mode and vehicle class (only when the powertrain selection is exogenous)	
By powertrain technology	M (only with exogenous powertrain selection)
By ICE fuel	M (only with exogenous powertrain selection)
Powertrain availability over time (only when the powertrain selection is endogenous) for each service, mode and vehicle class	
By powertrain technology	M (only with endogenous powertrain selection)
By ICE fuel	M (only with endogenous powertrain selection)
Vehicle costs by powertrain group	B
Vehicle and powertrain (projections)	
Vehicle costs by powertrain in the base year as well as over time for each service, mode (excluding AIR, NMT and PIPELINES) and vehicle class	
If powertrain selection is endogenous	A (policy input)
If powertrain selection is exogenous	B
Vehicle costs in AIR transport in the base year, as well as over time by service and vehicle class	B
Modal shares (exogenous projections)	
Evolution of the vehicle shares between TWO and THREE wheelers for each area (only for personal passenger vehicles)	A (M in regions with high three wheelers shares)
Evolution of the pkm shares in public transport modes for each area	M
Evolution of the vehicle shares in light road freight modes for each area	M
Vehicle classes (exogenous projections)	
Evolution of the vehicle shares by vehicle class for each area in case of:	
Personal passenger TWO WHEELERS	A
Personal passenger THREE WHEELERS	A
Personal passenger LDVS	A
Personal passenger VESSELS	A
Public passenger NMT	A
Public passenger TWO WHEELERS	A
Public passenger THREE WHEELERS	A

<i>Item</i>	<i>Category</i>
Public passenger LDVS	A
Public passenger VESSELS	A
Public passenger LARGE ROAD	A
Public passenger RAIL	A
AIR passenger	A
Medium road freight vehicles	A
Heavy road freight vehicles	A
Freight TWO WHEELERS	A
Freight THREE WHEELERS	A
Freight LDVS	A
Freight VESSELS	A
Freight RAIL	A
Freight AIR	A
Freight PIPELINES	A
Other inputs (projections)	
Pipelines – Average distance travelled by each volume unit for each area and class	M
Evolution of the crew costs per day by service and mode	A
Demand generation parameters	
Passenger – Drivers as functions of GDP per capita	
S-Curve parameters for personal passenger vehicles per capita	C
S-Curve parameters for pkm share on personal passenger vehicles in total pkm (including personal passenger vehicles and public transport)	C
S-Curve parameters for pkm share on air mode in total pkm (including personal passenger vehicles, public and air transport)	C
S-Curve parameters for people per active bike	C
S-Curve parameters for personal vessels (boats) per capita	C
Passenger – Elasticities as functions of GDP per capita by area type and mode	
Annual personal vehicle travel to cost of driving	C
Pkm by mode to cost of driving for public transport vehicles	C
Pkm by mode to cost of driving for air vehicles	c
Passenger – Environmental culture multipliers	
Personal Passenger Vehicles (PPV) per capita	C
Personal passenger LDVS	C
Pkm share on PPV in PPV + public transport	C
Pkm share on air mode in total pkm	C
People per active bike	C
Passenger – Vehicle travel cost multipliers	
Personal Passenger Vehicles (PPV) per capita	C
Personal passenger LDVS	C
People per active bike	C
Personal vessels (boats) per capita	C

<i>Item</i>	<i>Category</i>
Freight – Drivers as functions of GDP per capita	
Share of light vehicles in total road freight	C
Freight – Elasticities by large-freight submode and transport distance	
Tkm to the cost of tkm	C
Load factors to the cost of tkm	C

Need for coherence

It is of fundamental importance that inputs for each AREA, SERVICE, MODE, VEHICLE CLASS and POWERTRAIN TECHNOLOGY are coherently entered in the ForFITS Excel file.

If inputs on the PASSENGER vehicle stock are differentiated by AREA to treat urban and non-urban information differently, all other inputs (when requested by area) need to refer to the same transport and socio-economic system. This is necessary both for base year inputs and for projections. If, for instance, AREA I of the PASSENGER service contains data on urban vehicles, GDP and population data for PASSENGER service and AREA I also need to concern, respectively, the value added created in urban areas and the urban population. Projections on GDP and population growth for the same AREA and transport service (PASSENGER) must also refer to the same urban system.

This requirement for coherency does not oblige users to enter inputs with the same degree of disaggregation for different services. PASSENGER data, for instance, can be between urban and non-urban information in AREA I and AREA II, while FREIGHT inputs referring to the system constituted by the sum of the two passenger subgroups are entered under AREA I. In this case, FREIGHT inputs for AREA II are empty (i.e. initialized to zero), while all other AREA I inputs (for FREIGHT) must correspond to the entire system.

How to input and select data

Creation of cases/scenarios ("database section" of the worksheets)

Each input table of the "database section" is repeated (horizontally) several times to enable several datasets that the user may want to select and activate in the "selection section" of the file.

The colour coding is coherent with the explanation provided in the section on minimum data requirements. Figure C.2 shows an example with the inputs tables on the number of active vehicles in the base year for each service and split by mode and vehicle class ("User inputs (BASE Y)" tab). Green-shaded cells on the leftmost table indicate that at least one of these tables requires inputs from users (such inputs also need to be selected in the "selection section" to be transferred to Vensim). Light green shading indicates that, should there be other inputs, these would also contain a set of data included in the minimum requirements.

Figure C.2 Number of active vehicles ("User inputs (BASE Y)" tab), "database section": blank tables

Number of active vehicles

		DATABASE SECTION															
		CASES															
		User 1				User 2				User 3				User 4			
		User 1	User 2	User 3	User 4	User 1	User 2	User 3	User 4	User 1	User 2	User 3	User 4	User 1	User 2	User 3	User 4
SERVICE	MODE	User 1				User 2				User 3				User 4			
		VEHICLE CLASS				VEHICLE CLASS				VEHICLE CLASS				VEHICLE CLASS			
		A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
PASSENGER	MMT																
	TWO WHEELERS																
	THREE WHEELERS																
	LDVS																
	VESSELS																
	LARGE ROAD																
	RAIL																
	AIR																
	PIPELINES																
FREIGHT	MMT																
	TWO WHEELERS																
	THREE WHEELERS																
	LDVS																
	VESSELS																
	LARGE ROAD																
	RAIL																
	AIR																
	PIPELINES																

SELECTION SECTION



Figure C.3 Number of active vehicles ("User inputs (BASE Y)" tab), "database section": some tables with data

Number of active vehicles

		DATABASE SECTION															
		CASES															
		FR Urban				FR Rural				FR total				Zeros			
		Urban	Rural	Total	Zeros	Urban	Rural	Total	Zeros	Urban	Rural	Total	Zeros	Urban	Rural	Total	Zeros
SERVICE	MODE	FR Urban				FR Rural				FR total				Zeros			
		VEHICLE CLASS				VEHICLE CLASS				VEHICLE CLASS				VEHICLE CLASS			
		A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
PASSENGER	MMT	4893345	31295	0	0	1284982	2678883	0	0	6366012	11116	0	0	0	0	0	0
	TWO WHEELERS	0	1474200	772200	0	0	0	625800	327800	0	0	0	0	0	0	2160000	100000
	THREE WHEELERS	2498	0	0	352	0	0	704	0	86	0	3200	0	400	0	0	0
	LDVS	0	10322440	9185200	2444400	54380	0	4065500	2614720	1255520	3782	0	14400000	12000000	4800000	58000	0
	VESSELS	0	0	0	40	0	0	173800	0	160	0	790000	0	0	0	200	0
	LARGE ROAD	0	30000	7224	190	8424	0	0	1896	0	3576	0	30000	8420	100	12000	0
	RAIL	0	100	1760	785	785	596	0	0	0	65	26	0	100	1760	785	355
	AIR	562	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	PIPELINES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FREIGHT	MMT	4200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWO WHEELERS	40	0	0	20	20	0	0	0	0	0	0	0	0	0	0	0
	THREE WHEELERS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	LDVS	2400000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	VESSELS	336	78	0	0	78	0	0	0	0	0	0	0	0	0	0	0
	LARGE ROAD	300000	0	0	0	236208	0	0	0	0	0	0	0	0	0	0	0
	RAIL	60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	AIR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	PIPELINES	0	4.88E+10	1E+08	0	0	0	0	0	0	0	0	0	0	0	0	0

SELECTION SECTION



The user can fill the tables needed in the "database section" (see also Figure C.3) and select one or more of them (depending on the case) in the "selection section".

If inputs are required for each area, the user may enter the total number of vehicles in one area (while introducing zeros in the other) or consider inputs on urban and non-urban areas separately (WARNING: the last example requires consistent treatment of the data for the same areas across the whole file! GDP, population, etc. also need to refer to the urban and/or non-urban fraction, for instance).

The header of each single table shown in Figure C.3 (FR Urban, FR Rural, FR total, Zeros, etc. in the Figure) can be introduced/modified by the user. All the headers of the input tables are linked to a table gathering all of them (Figure C.4). In the example, this table is located above the inputs tables and characterized by the same colour coding throughout. Also for this table, green-shaded cells on the leftmost table indicate that at least one of these tables requires input from user. Light green shading indicates that, should there be other inputs, they would also contain a set of data included in the minimum requirements.

Figure C.4 Number of active vehicles ("User inputs (BASE Y)" tab), "database section": list of cases according to the header of each inputs table

		CASES																					
	I	FR	FR	FR	Zeros	User 1	User 2	User 3	User 4	User 5	User 6	User 7	User 8	User 9	User 10	User 11	User 12	User 13	User 14	User 15	User 16		
PASSENGER	FR	urban	FR	rural	FR	total	Zeros	User 1	User 2	User 3	User 4	User 5	User 6	User 7	User 8	User 9	User 10	User 11	User 12	User 13	User 14	User 15	User 16
FREIGHT	FR	Zeros	User 1	User 2	User 3	User 4	User 5	User 6	User 7	User 8	User 9	User 10	User 11	User 12	User 13	User 14	User 15	User 16	User 17	User 18			

Selection of the case ("selection section" of the worksheets)

The inputs tables on the left are the ones taken into account when running the model.

Selection cells are always located in tables within the columns B to E of the worksheets.

- For inputs concerning the base year, the selection table (i.e. the table containing the selection cells) are normally located below the short description of the input table including the title, the units in which the inputs must be introduced as well as explanatory notes when necessary (Figure C.5).

Figure C.5 Number of active vehicles ("User inputs (BASE Y)" tab), "database section" "selection section": selection table and active table, containing data selected from the database section and used by the Vensim file

SELECTION SECTION

Number of active vehicles
(vehicle stock, base year)
[vehicles]
Note: for pipelines, each cubic metre transported is considered as a "vehicle". As a result, the input required for pipelines corresponds to the annual volume transported, expressed in cubic metres

SELECTION TABLE

SERVICE	AREA	II
PASSENGER	FR	urban
PASSENGER	FR	rural
FREIGHT	FR	Zeros

TITLE, UNITS, ETC.

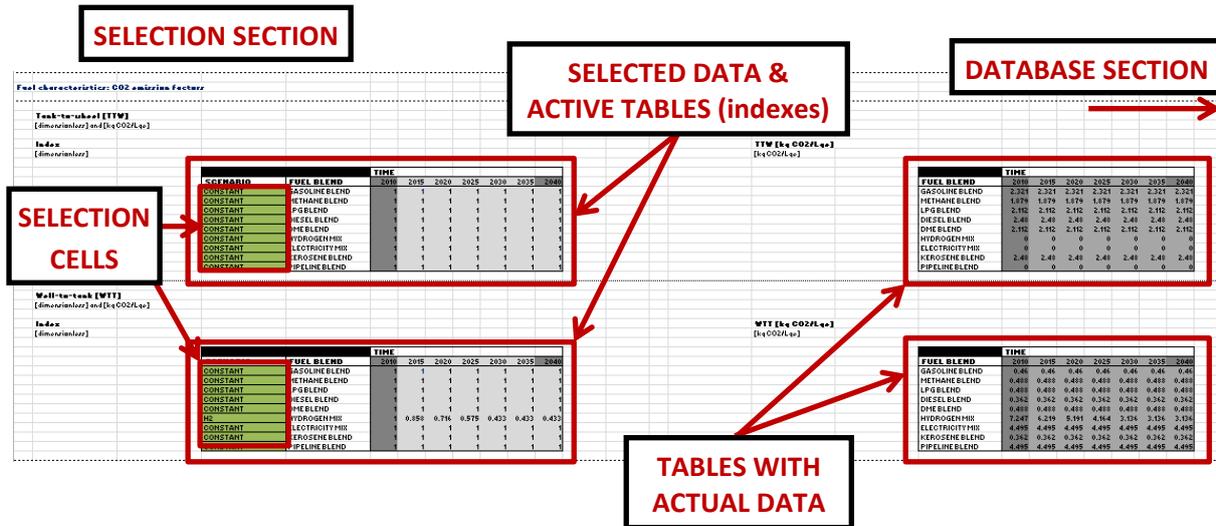
SELECTED DATA & ACTIVE TABLE

SERVICE	MODE	AREA						BY MODE	II						BY MODE			
		VEHICLE CLASS							VEHICLE CLASS									
		A	B	C	D	E	F		A	B	C	D	E	F				
PASSENGER	NMT	45683049	91368				0	2246400	12884963	25770					0	0	0	952600
	TWO WHEELERS	0	1474200	772200	0	0	0	2808	704	625900	327800	0	0	0	0	0	0	792
	THREE WHEELERS	2496	0	0	312	0	0	23017488	0	0	88	0	0	0	0	0	0	0
	LDVS	0	10333440	9185280	3444480	54288	0	23017488	0	0	0	0	0	0	0	0	0	8040512
	VESSELS	616200	0	0	0	40	0	616240	173800	0	0	0	160	0	0	0	0	173960
	LARGE ROAD	0	30000	7224	100	8424	0	45748	0	0	1196	0	3576	0	0	0	0	4772
	RAIL	0	0	100	1760	765	765	516	0	0	0	0	0	0	0	0	0	95
	AIR	562	0	0	0	0	0	562	38	0	0	0	0	0	0	0	0	38
	PIPELINES																	
FREIGHT	NMT	4200	0	0	0	0	0	4200	0	0	0	0	0	0	0	0	0	0
	TWO WHEELERS	40	0	0	0	0	20	20	80	0	0	0	0	0	0	0	0	0
	THREE WHEELERS	2400000	0	0	0	0	0	2400000	0	0	0	0	0	0	0	0	0	0
	LDVS	338	75	0	0	0	75	488	0	0	0	0	0	0	0	0	0	0
	VESSELS	140000	0	0	0	0	0	132000	0	0	0	0	0	0	0	0	0	0
	LARGE ROAD	60	0	0	0	0	0	60	0	0	0	0	0	0	0	0	0	0
	RAIL	60	0	0	0	0	0	60	0	0	0	0	0	0	0	0	0	0
	AIR	60	0	0	0	0	0	60	0	0	0	0	0	0	0	0	0	0
	PIPELINES	0	4.682E+10	100000000	0	0	0	0	0	0	0	0	0	0	0	0	0	0

DATABASE SECTION

- For inputs on data over time, the selection cells are normally located on the left of the active table, typically containing indexes defining the evolution of base year variables (Figure C.6). Additional tables may show the results of applying the indexes to the actual variables affected.

Figure C.6 Fuel characteristics: CO₂ emission factors ("User inputs (over time)" tab), "selection section": selection cells, active tables (indexes), containing data selected from the "database section", and tables with actual data transferring information to Vensim



The active tables shown in Figure C.5 and Figure C.6 are automatically filled in when the user selects a case/scenario for each service and area.

The selection requires the user to click on a selection cell and to choose among the options listed. This list contains the headers of the different tables located in the "database section" of the input table under consideration. For instance, if the user clicks on the cells corresponding to PASSENGER (any area) of the selection table for the number of active vehicles (Figure C.5), the headers listed in the first row of the "database section" are made available (Figure C.7).

Figure C.7 Number of active vehicles, "selection section", selection table: choosing the cells from "database section" which should be active

SERVICE	AREA
PASSENGER	FR urban
FREIGHT	FR urban
	FR rural
	FR total
	Zeros
	User 1
	User 2
	User 3
	User 4
	MC
	NM

The selection of an option, as in Figure C.7, transfers data from one of the cases defined on "database section" of the worksheet to the part of the active table corresponding to the indications given in the selection table (i.e. PASSENGER SERVICE, AREA I).

The following sections contain a number of examples further explaining the logic of the selection of data in the ForFITS Excel file.

Inputs without the possibility of defining cases/scenarios

Figure C.8 Initial conditions - Fuel consumption ratios by powertrain for each mode and service

Fuel consumption gap by powertrain group (new registrations, base year-5) (ratio with respect to GASOLINE PICE) Note: technical input, unlikely to require changes													
POWERTRAIN GROUP	SERVICE PASSENGER					FREIGHT							
	MODE					MODE							
	TWO VHEE	THREE VH	LDOVS	VESSELS	LARGE RO	RAIL	TWO VHEE	THREE VH	LDOVS	VESSELS	LARGE RO	RAIL	
GASOLINE PICE	1	1	1	1	1	1	1	1	1	1	1	1	
GASOLINE PICE-HYDRAULIC HYBRID	0.983322	0.9537484	0.7466612	0.908625	0.77475	0.908625	0.983322	0.9537484	0.7466612	0.908625	0.980025	0.908625	
GASOLINE PICE-ELECTRIC HYBRID	0.9803909	0.9455863	0.7019544	0.8925	0.735	0.8925	0.9803909	0.9455863	0.7019544	0.8925	0.9765	0.8925	1.05
METHANE PICE	1	1	1	1	1	1	1	1	1	1	1	1	
METHANE PICE-HYDRAULIC HYBRID	0.883322	0.9537484	0.7466612	0.908625	0.77475	0.908625	0.883322	0.9537484	0.7466612	0.908625	0.980025	0.908625	
METHANE PICE-ELECTRIC HYBRID	0.8803909	0.9455863	0.7019544	0.8925	0.735	0.8925	0.8803909	0.9455863	0.7019544	0.8925	0.9765	0.8925	
LPG PICE	1	1	1	1	1	1	1	1	1	1	1	1	
LPG PICE-HYDRAULIC HYBRID	0.983322	0.9537484	0.7466612	0.908625	0.77475	0.908625	0.983322	0.9537484	0.7466612	0.908625	0.980025	0.908625	
LPG PICE-ELECTRIC HYBRID	0.9803909	0.9455863	0.7019544	0.8925	0.735	0.8925	0.9803909	0.9455863	0.7019544	0.8925	0.9765	0.8925	
DIESEL CICE	1.0305519	1.0249599	0.8527595	0.86	0.86	0.86	1.0305519	1.0249599	0.8527595	0.86	0.86	0.86	1.075
DIESEL CICE-HYDRAULIC HYBRID	1.0236811	1.0060328	0.7863446	0.828567	0.782514	0.828567	1.0236811	1.0060328	0.7863446	0.828567	0.8531286	0.828567	
DIESEL CICE-ELECTRIC HYBRID	1.0224686	1.0026864	0.751095	0.82302	0.76984	0.82302	1.0224686	1.0026864	0.751095	0.82302	0.85196	0.82302	
DIME CICE	1.0305519	1.0249599	0.8527595	0.86	0.86	0.86	1.0305519	1.0249599	0.8527595	0.86	0.86	0.86	
DIME CICE-HYDRAULIC HYBRID	1.0236811	1.0060328	0.7863446	0.828567	0.782514	0.828567	1.0236811	1.0060328	0.7863446	0.828567	0.8531286	0.828567	
DIME CICE-ELECTRIC HYBRID	1.0224686	1.0026864	0.751095	0.82302	0.76984	0.82302	1.0224686	1.0026864	0.751095	0.82302	0.85196	0.82302	
HYDROGEN ICE	1	1	1	1	1	1	1	1	1	1	1	1	
HYDROGEN ICE-HYDRAULIC HYBRID	0.883322	0.9537484	0.7466612	0.908625	0.77475	0.908625	0.883322	0.9537484	0.7466612	0.908625	0.980025	0.908625	
HYDROGEN ICE-ELECTRIC HYBRID	0.8803909	0.9455863	0.7019544	0.8925	0.735	0.8925	0.8803909	0.9455863	0.7019544	0.8925	0.9765	0.8925	
FC	0.9468481	0.8952722	0.5342406	0.325	0.5342406	0.325	0.9468481	0.8952722	0.5342406	0.325	0.5342406	0.325	1.05
FC-ELECTRIC HYBRID	0.9378647	0.8709146	0.4546265	0.3075313	0.4634537	0.3075313	0.9378647	0.8709146	0.4546265	0.3075313	0.5279633	0.3075313	1.05
ELECTRIC	0.8986704	0.8230055	0.2333916	0.316	0.316	0.316	0.8986704	0.8230055	0.2333916	0.316	0.316	0.316	1.05
KEROSENE TURBINE													
PIPELINE PUMPS													
PLUG-INs: share of electric driving	0.4	0.3	0.2	0.01	0.01	0.5	0.4	0.3	0.2	0.01	0.01	0.5	

In a few cases (tables on the historical fuel consumption ratios by powertrain in the base year, shown in Figure C.8), the technical inputs are not expected to require changes (orange-shaded cells). Inputs for these cases shall be entered directly in the tables, without the possibility of defining cases/scenarios.

Note: inputs on the historical fuel consumption ratios by powertrain in the base year require consistency and coherence. Information for vehicle registrations that took place in the past needs to fit with the data entered for the vehicles belonging to the stock.

Examples

1. Inputs without the possibility of defining cases/scenarios in the "database section"

The area characterization input ("Transport system (over time)" sheet) is set by the user by choosing one of the model's area types (URBAN, NON-URBAN, NON-SPECIFIED). The dark grey cells contain information that cannot be manipulated (Figure C.9).

Figure C.9 Area characterization

Area characterization (ruitelch)		SELECTION SECTION		DATABASE SECTION	
Selection ruitelcher	SERVICE	AREA	II	URBAN	NON-URBAN
	PASSENGER	URBAN	NON-URBAN	URBAN	NON-URBAN
				NON-SPECIFIED	

2. Initial conditions/Vehicle stock/Vehicles/Powertrain group shares in each vehicle class

At least one option in each row of the table containing inputs on powertrain group shares in each vehicle class ("User inputs (BASE Y)" sheet) requires filling in (if vehicles are in the corresponding mode and class). The cells of the tables of the "database section" are colour-coded in a way that is consistent with minimum data requirements (Figure C.10).

Figure C.10 Powertrain group shares in each vehicle class

DATABASE SECTION			CASES																													
			FR Urban	FR rural	User 2	User 3	User 4	User 5	User 6	User 7	User 8	User 9	User 10	User 11	User 13	User 14	User 15	User 16	User 17	User 18	User 19	User 20										
SERVICE	MODE	VEHICLE CLASS	FR Urban										User 2																			
			POWERTRAIN GROUP					POWERTRAIN GROUP					POWERTRAIN GROUP					POWERTRAIN GROUP														
			GASOLIN	METHAN	LPG	PHIC	DIESEL	C	DIESEL	C	ELECTRN	GASOLIN	METHAN	LPG	PHIC	DIESEL	C	DIESEL	C	ELECTRN	GASOLIN	METHAN	LPG	PHIC	DIESEL	C	DIESEL	C	ELECTRN			
PASSENGER	TWO WHEELERS	A	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
		B	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
		C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		D	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	
		E	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
		F	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
	THREE WHEELERS	A	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
		B	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	
		C	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	
		D	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		E	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
		F	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
	LDVS	A	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	
		B	0.441688	0.006782	0	0	0.55153	0	0	0.431025	0.006782	0	0	0.542192	0	0	0.542192	0	0	0	0	0	0	0	0	0	0	0	0	0		
		C	0.353897	0.010173	0	0	0.62993	0	0	0.347468	0.010173	0	0	0.642359	0	0	0.642359	0	0	0	0	0	0	0	0	0	0	0	0	0		
		D	0.441688	0.006782	0	0	0.55153	0	0	0.431025	0.006782	0	0	0.542193	0	0	0.542193	0	0	0	0	0	0	0	0	0	0	0	0	0		
		E	0.285758	0.010174	0	0	0.724668	0	0	0.250944	0.010175	0	0	0.738882	0	0	0.738882	0	0	0	0	0	0	0	0	0	0	0	0	0		
		F	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
	LARGE ROAD	A	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	
		B	0.006376	0.002521	0	0	0.990093	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
		C	0.005044	0.004148	0	0	0.322608	0	0	0.005338	0.002525	0	0	0.990526	0	0	0.990526	0	0	0	0	0	0	0	0	0	0	0	0	0		
		D	0.00241	0.661855	0	0	0.335735	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		E	0.006375	0.002529	0	0	0.990096	0	0	0.005937	0.002528	0	0	0.990535	0	0	0.990535	0	0	0	0	0	0	0	0	0	0	0	0	0		
		F	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
	RAIL	A	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1		
		B	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1		
		C	0	0	0	0	0	0.5	0	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1		
		D	0	0	0	0	0	0.5	0	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1		
		E	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1		
		F	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1		

SELECTION SECTION



When the user selects an input dataset, an automatic procedure checks that the sum of the shares across all technologies results in 1. If this is not so, an error message appears in the active table, as a red cell (Figure C.11). User correction is required to avoid errors in Vensim.

This example recalls the importance of always manipulating the tables of the "database section", and not the "active tables" (which would compromise the procedures of the following selection).

Figure C.11 Error detected

DATABASE SECTION			CASES																											
			FR Urban	FR rural	User 2	User 3	User 4	User 5	User 6	User 7	User 8	User 9	User 10	User 11	User 13	User 14	User 15	User 16	User 17	User 18	User 19	User 20								
SERVICE	MODE	VEHICLE CLASS	FR Urban										User 2																	
			POWERTRAIN GROUP					POWERTRAIN GROUP					POWERTRAIN GROUP					POWERTRAIN GROUP												
			GASOLIN	METHAN	LPG	PHIC	DIESEL	C	DIESEL	C	ELECTRN	GASOLIN	METHAN	LPG	PHIC	DIESEL	C	DIESEL	C	ELECTRN	GASOLIN	METHAN	LPG	PHIC	DIESEL	C	DIESEL	C	ELECTRN	
PASSENGER	TWO WHEELERS	A	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		B	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		D	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		E	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		F	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	THREE WHEELERS	A	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		B	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		C	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		D	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		E	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		F	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	LDVS	A	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		B	0.52	0.0067822	0	0	0.5515299	0	0	0.431025	0.006782	0	0	0.542192	0	0	0.542192	0	0	0	0	0	0	0	0	0	0	0		
		C	0.3538969	0.0101733	0	0	0.6299298	0	0	0.347468	0.010173	0	0	0.642359	0	0	0.642359	0	0	0	0	0	0	0	0	0	0	0		
		D	0.441688	0.0067822	0	0	0.5515298	0	0	0.431025	0.006782	0	0	0.542192	0	0	0.542192	0	0	0	0	0	0	0	0	0	0	0		
		E	0.2851585	0.010174	0	0	0.7246675	0	0	0.250944	0.010175	0	0	0.738882	0	0	0.738882	0	0	0	0	0	0	0	0	0	0	0		
		F	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	LARGE ROAD	A	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		B	0.0063759	0.002531	0	0	0.9900931	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		C	0.005044	0.0041484	0	0	0.3226076	0	0	0.005338	0.002525	0	0	0.990526	0	0	0.990526	0	0	0	0	0	0	0	0	0	0	0		
		D	0.00241	0.6618548	0	0	0.3357352	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		E	0.0063755	0.0025287	0	0	0.9900958	0	0	0.005937	0.002528	0	0	0.990535	0	0	0.990535	0	0	0	0	0	0	0	0	0	0	0		
		F	0	0	0	0																								

The evolution of the "passenger transport system index" must be introduced for the time periods included between the base year and the final year, as specified by the users (green-shaded years). Times must be set progressively by the user. Values in between the times indicated are linearly interpolated.

Other than times, users also need to enter the information on the evolution of the "passenger transport system index" itself. Only one column is shaded in green in the "database section". This means that at least one scenario must be defined.

Figure C.12 Definition of scenarios for the passenger transport system index

Passenger transport system index							
DATABASE SECTION							
Variation index							
TIME	SCENARIOS						
	CONSTAN	GROWING	User 2	User 3	User 4	User 5	User 6
2010	1	1	1	1	1	1	1
2015	1	1.043097					
2020	1	1.086194					
2025	1	1.129291					
2030	1	1.172388					
2035	1	1.215485					
2040	1	1.258582					

SELECTION SECTION

←

Figure C.13 shows that the selection of one dataset heading in the selection cells on the "passenger transport system index" results in the transfer of the "database section" values corresponding to the same dataset heading in the active table ("selection section").

An auxiliary table, reproduced in the "selection section" (and in Figure C.13), contains the resulting evolution of the "transport characteristic index" taking into account for the base year value², displayed with a dark grey shading, and the changes of the "passenger transport system index", defining the evolution of the base year value of the "transport characteristic index" over time.

In this specific case, a check ensures that the resulting evolution of the "transport characteristic index" is always within the range from 0 to 1.

² This value is calculated in the "Passenger transport index" sheet on the basis of input data entered elsewhere in the "User inputs (BASE Y)" and "Demand generation parameters" sheets. The calculation methodology is the same as that described in the explanation of the "demand" views of the Vensim model.

Figure C.13 Selection of the scenario for the passenger transport system index

Passenger transport system index [index]	SELECTION SECTION									
Variation index			TIME							
	SCENARIO	AREA	2010	2015	2020	2025	2030	2035	2040	
	CONSTANT	I	1	1	1	1	1	1	1	
	CONSTANT	II	1	1	1	1	1	1	1	

Passenger transport characteristic index [values from 0 to 1]	SELECTION SECTION								
			TIME						
	AREA		2010	2015	2020	2025	2030	2035	2040
	I		0.56	0.556181	0.556181	0.556181	0.556181	0.556181	0.556181
	II		0.06	0.063654	0.063654	0.063654	0.063654	0.063654	0.063654
			OK	OK	OK	OK	OK	OK	OK

This is the same structure used for the inputs characterizing the freight transport system over time. In particular, the shares of tonnes lifted at the base year disaggregated at different levels are automatically calculated as reference value, while the evolution over time is input through an index. The user must introduce information on an index defining the evolution of the base year value over time.

Excel inputs concerning an index that determines the evolution over time are generally accompanied by an information table with the resulting changes to the parameter modified by the time-dependent index.

4. Fuel consumption (projections)/All modes but air, NMT and pipelines/Fuel consumption characteristics by powertrain

Inputs on the fuel consumption characteristics by powertrain are in the "Pwtrn potential" sheet. These inputs allow the user to define the evolution over time of the fuel consumption of the different technologies according to expected technical (and, eventually, behavioural) developments.

Note:

- the inputs on fuel consumption characteristics by powertrain must be closely linked with cost-inputs by powertrain, located in the "Cost inputs by pwtrn" sheet.
- the complexity of the inputs required here corresponds with the orange colour-code (also used for similar inputs in the "User inputs (BASE Y)" sheet and in the "Cost inputs by pwtrn". Green was used here, giving priority to the need to provide clear information on the minimum requirements.

The user input takes the form of ratios characterizing each powertrain option with respect to the GASOLINE PI ICE technology, with the latter taken as reference technology. The user must also specify the variation expected for GASOLINE PI ICE vehicles through an index that compares the performance over time with the base year value. Data are required for each service and mode.

Figure C.14 shows an example (passenger two wheelers) of possible "database" cases that could be selected in the active table. The green cells indicate that at least one scenario, containing information for the final year (2040, in the example), should be defined. If input for the last year is

unavailable, then the powertrain ratios in the last year of the projections are assumed to be the same as those in the initial year.

Note: the database cases "2025 default" and "2040 default" of this and other tables of the "Pwtrn potential" sheet are currently filled with default data based on research reports that provide outputs on expected short-term and long-term performance improvements that are coherent with the default data entered in the "Cost inputs by pwtrn" sheet.

Figure C.14 Fuel consumption characteristics by powertrain, Passenger two wheelers, "database section"

			CASES									
			2040 default	2025 default	2040 default	User 1	User 2	User 3	User 4	User 5		
			TIME									
SERVIC	MODE	POWERTRAIN GROUP	2040	2025	2040							
PASSENG	TWO WHE	GASOLINE P1ICE	0.948266	0.952062	0.952062							
		GASOLINE P1ICE-HYDRAULIC HYBRID	0.929748	0.933706	0.933706							
		METHANE P1ICE	0.97	0.97	0.97							
		METHANE P1ICE-HYDRAULIC HYBRID	0.919818	0.9235	0.9235							
		METHANE P1ICE-ELECTRIC HYBRID	0.901855	0.905694	0.905694							
		LPG P1ICE	1	1	1							
		LPG P1ICE-HYDRAULIC HYBRID	0.948266	0.952062	0.952062							
		LPG P1ICE-ELECTRIC HYBRID	0.929748	0.933706	0.933706							
		DIESEL C1ICE	0.958653	0.958653	0.958653							
		DIESEL C1ICE-HYDRAULIC HYBRID	0.913475	0.916417	0.916417							
		DIESEL C1ICE-ELECTRIC HYBRID	0.895364	0.898563	0.898563							
		DME C1ICE	0.958653	0.958653	0.958653							
		DME C1ICE-HYDRAULIC HYBRID	0.913475	0.916417	0.916417							
		DME C1ICE-ELECTRIC HYBRID	0.895364	0.898563	0.898563							
		HYDROGEN ICE	0.97	0.97	0.97							
		HYDROGEN ICE-HYDRAULIC HYBRID	0.919818	0.9235	0.9235							
		HYDROGEN ICE-ELECTRIC HYBRID	0.901855	0.905694	0.905694							
		FC	1.025748	1.019598	0.90176							
		FC-ELECTRIC HYBRID	0.994744	0.975523	0.862779							
		ELECTRIC	0.990261	0.967718	0.855877							
		% OF ELECTRIC DRIVING IN PLUG-INS	0.4	0.4	0.5							
		FUEL CONS. INDEX, GASOLINE P1ICE	0.859283	0.884427	1							

SELECTION SECTION

Figure C.15 Fuel consumption characteristics by powertrain, Passenger two wheelers, "selection section"

The screenshot shows the 'selection section' of the spreadsheet with several tables highlighted by red boxes and arrows:

- SELECTION TABLE:** A table with columns for 'SELECTION' and 'MODE'. It lists '2040 default', '2025 default', 'User 2', and 'User 2'.
- SELECTED DATA & ACTIVE TABLE:** A large table with columns for 'SERVIC', 'MODE', 'POWERTRAIN GROUP', and 'TIME'. It lists various powertrain groups like 'GASOLINE P1ICE', 'GASOLINE P1ICE-HYDRAULIC HYBRID', etc., and their corresponding fuel consumption values for different years and users.
- TABLE OF SELECTED CASES:** A table with columns for 'TIME', '2040 default', '2025 default', 'User 2', 'User 2', 'User 2', and 'User 2'. It lists the selected cases for each year and user.
- DATABASE SECTION:** A table with columns for 'TIME', '2040 default', '2025 default', '2040 default', 'User 1', 'User 2', 'User 3', 'User 4', and 'User 5'. It lists the fuel consumption values for each powertrain group across different years and users.
- AUXILIARY TABLE FOR CASE ORDERING:** A table with columns for '2010', '2010', '2010', '2010', '2010', '2010', and '2010'. It lists the case ordering for each year.

The user's selection (requiring choices in the selection table, shown in Figure C.15) is also reflected in the table called "SELECTED CASES" (also on Figure C.15).

The final inputs table coupled to the Vensim file are located in the active table (centre-left of Figure C.15). This table collects historical information introduced in the "User inputs (BASE Y)" sheet and the information relative to the selected "database" cases. An auxiliary table orders the selected

cases by chronology in the active table. For HYBRID PLUG-IN powertrains, the data in the active table (black colour-code instead of blue) results from the combination of inputs on the technology ratios for hybrid and electric vehicles taking into account the inputs on the projected percentage of electric driving.

5. Technology choice (Projections)/A) EXOGENOUS TECHNOLOGY CHOICE INPUTS/Powertrain technology and ICE fuel: shares

These inputs are only operational when the powertrain choice is exogenous.

Inputs on powertrain technology availability need to be entered in the "Pwtrn shares" sheet. Data for the base year are defined automatically on the basis of the information provided in the "User inputs (BASE Y)" sheet.

In an exogenous case, similar inputs are required to define the projected technology availability (see Box 2 for information that is specifically relevant for this case).

In order to simplify the inputs, the shares required to distribute the new vehicle registrations over time across the different technologies are divided into two groups: POWERTRAIN TECHNOLOGY shares and ICE FUEL shares (where ICE stands for Internal Combustion Engine). The combination of both inputs results in the shares of new vehicles by powertrain. This is the input considered in the model.

The "database section" is placed below the "selection section" in this worksheet (This is illustrated in Figure C.17 which contains a description of the tables).

Box 2 Exogenous powertrain choice: technology availability

A choice of endogenous technology requires inputs on technology availability and is very similar to the case of inputs on powertrain shares (needed with an exogenous technology choice). Inputs on powertrain technology availability must be entered in the "Pwtrn availability" sheet. Data for the base year availability are defined by default according to the relationship shown in Figure C.16.

Figure C.16 Technology availability as a function of technology shares on the market in the base year

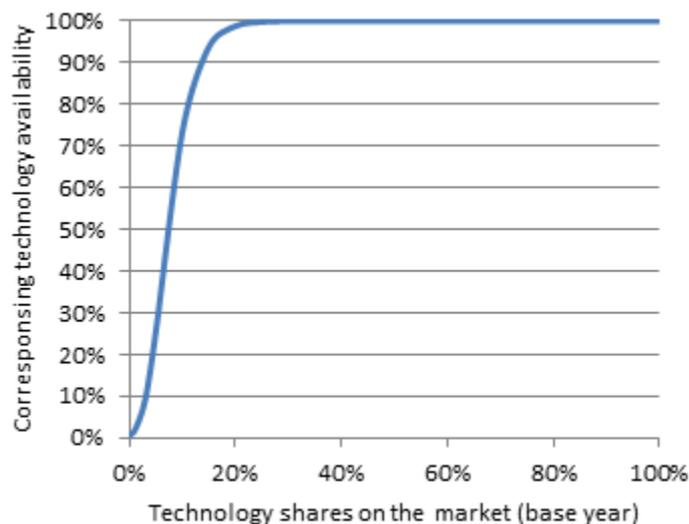
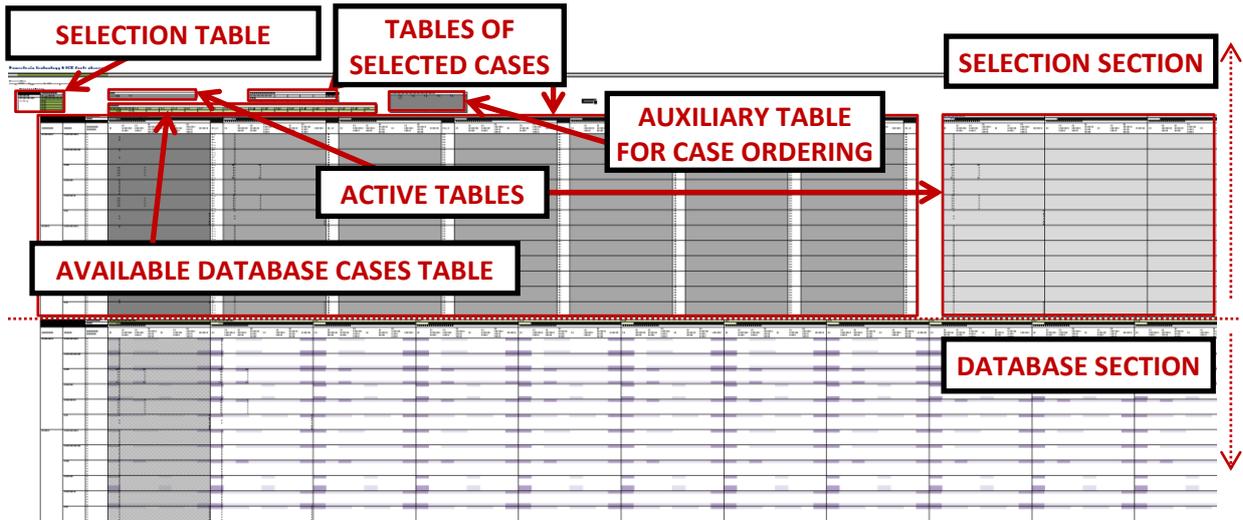


Figure C.17 Top tables of the "Pwtrn shares" sheet



User inputs are required for times between the base year and the final year (included). Time gaps are filled by linear interpolations. Inputs in the final year of the projections are necessary for the Vensim file (for this reason, they are a minimum requirement in this Excel sheet). If data is missing on the powertrain shares in the final year, the initial powertrain shares will be assumed to be valid in the final year.

The selection of the inputs entered in the "database section" (shown specifically in Figure C.18) is made in the selection table, located on the top left area for each set of input tables (POWERTRAIN TECHNOLOGY shares and ICE FUEL shares) (Figure C.17). User inputs need to be coupled with a name and time (year) for each specific set of data (each case). These names are also reproduced in the "available database cases table" of the "selection section" (Figure C.17). The selection table uses these names to identify different datasets for transfer to the active tables.

Figure C.18 "Pwtrn shares" sheet: "database section"

SERVICE	MODE	VEHICLE CLASS	POWERTRAIN TECHNOLOGY															ICE FUEL SHARES														
			ICE					ELECTRIC					FC					ICE					ELECTRIC					FC				
			ICE	HYBRID	ELECTRIC	HYBRID	FC	ELECTRIC	HYBRID	FC	ELECTRIC	HYBRID	FC	ICE	HYBRID	ELECTRIC	HYBRID	FC	ELECTRIC	HYBRID	FC	ICE	HYBRID	ELECTRIC	HYBRID	FC	ELECTRIC	HYBRID	FC			
PASSENGER	TWO WHEELERS	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
		C	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
		F	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
	MOTOR VEHICLES	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
		C	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
		F	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
	LDT	A	0.91	0	0.09	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
		C	0.91	0	0.09	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
		F	0.91	0	0.09	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
	VESICLE	A	0.99	0	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
		C	0.99	0	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
		F	0.99	0	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
LARGE ROAD	A	0.91	0	0.09	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
	C	0.91	0	0.09	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
	F	0.91	0	0.09	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
TRUCK	A	0.91	0	0.09	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
	C	0.91	0	0.09	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
	F	0.91	0	0.09	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				

Note: cells in the "database section" are shaded so as to be consistent with the description given in Table C.1. Error! Reference source not found..