ASSIST

Assessing the social and economic impacts of past and future sustainable transport policy in Europe



The ASTRA-EC model user guide

Extract of deliverable D6.1 of the ASSIST project

Grant Agreement Number: 265381 Contract No: MOVE/FP7/265381/ASSIST Instrument: Coordination and support actions – Support – CSA-SA





Project co-funded by the European Commission – DG MOVE 7th Research Framework Programme





ASSIST

Assessing the social and economic impacts of past and future sustainable transport policy in Europe



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1 Content of the user guide

Welcome to the ASTRA-EC Model Interface (from now on called Interface). This guide is intended to walk you through discovering the functionalities of the Interface.

Any user should be able to play with the Interface, but a basic knowledge of the Vensim terminology (like view, sketch, subscript) is useful.

The ASTRA-EC Model Interface is an application of the Vensim software (Venapp) that simplify viewing the structure, examining the causality, and simulating and viewing the behaviour in the ASTRA-EC Model. You are not allowed to modify the structure of the model, neither the equations of its variables.

1.1 System requirements

In order to run the ASTRA-EC model interface either the Vensim Model Reader or any commercial version of Vensim should be installed on the computer (Vensim software can be downloaded from http://vensim.com/).

You also need a software like MS Excel or LibreOffice Calc to open some files in ".xls" format.

A specific utility (ASTRA_EC_utility.exe) was developed in order to extend the functionalities provided by an usual Venapp. In particular, it is delegated to show the subscripts dictionary and the legend of the variables in a model structure screen (see chapter **Errore. L'origine riferimento non è stata trovata.**), draw a thematic map on the data of an indicators screen (see chapter 5.3.2.1) and create the radar graphs shown on the key indicators screens (see chapter 5.3.1.2). This utility was built for a Windows machine, the package has not been tested on any other operating system.

1.1.1 International settings

In some cases, external data is provided to the ASTRA-EC model interface (e.g. for detailed policy input, see section 4.2). The ASTRA-EC interface expects numbers where **thousands separator is comma** and **decimal symbol is dot**, e.g.:

1,456,456.77

If a different format is used the number could not be recognised, running the model could become impossible (a floating point error could be issued, see Annex 3) or results could be biased.

The easiest way to ensure that international settings are consistent with the requirement of the interface is to set the keyboard language to English. This can be done just by clicking on the language icon in the lower-right corner of the screen in Excel (see Figure 1-1) and choosing "EN".



Figure 1-1: The language icon in Excel

1.2 Installation procedure

First of all you have to install the Vensim Model Reader (downloadable for free from http://vensim.com/free-download/) or any commercial version of the Vensim Software, if you still do not have it.

The ASTRA-EC Model Interface package consists of the following files:

- ASTRA-EC_model_interface.vpa
- ASTRA_EC_Sc_Reference.vdf
- the subfolder "interface", including the following files:
 - input_CarRoadPricing.xls
 - input_ExogEmission.xls
 - input_ExogExternality.xls
 - input_ExogFuelPrice.xls
 - input_ExogGDP.xls
 - input_ExogPOLES.xls
 - input_ExogTT.xls
 - input_InternExternalityFre.xls
 - input_InternExternalityPass.xls
 - input_RailwayChargeFre.xls
 - input_RailwayChargePass.xls
 - input_TruckRoadPricing.xls
 - input_UrbanRoadCharge.xls
 - ASTRA_EC_utility.exe

- thematism.xml

After having copied the whole folder (respecting the structure of the sub-folder "interface") in any position you prefer, the installation is completed. By double-clicking on the ASTRA-EC_model_interface.vpa file, you will start the program.

2 The Interface

The starting screen of the Interface is shown in Figure 2-1.



Source: TRT

Figure 2-1: The starting screen of the Interface

The link under the title of the project redirect the user to the internet home page of the project (<u>www.assist-project.eu</u>).

By clicking on the **Enter** link, the model will be loaded and the ASTRA-EC utility will be started. This can require some time depending on the hardware system.

An icon representing the ASSIST logo will appear in the system tray bar and a message will confirm that the utility has been successfully launched.

As soon as the model is ready, you will enter the HOME screen, shown in Figure 2-2.

The screen shows three buttons and the explanation of their relative purposes. Each button drives to one of the three main parts, which the interface consists of.

Structure: to explore the model structure and the linkages between modules

Simulation: to implement transport policy measures (individually or in packages) and test the impacts of exogenous scenarios (e.g. population growth).

Ouput: to analyse the output of the simulations with reference to transport, economic, environmental and social indicators.

755151	HOME	ASTRA-EC model ASsessment of TRansport strategies		
	STRUCTURE	SIMULATION	OUTPUT	
	To explore the model structure, the linkages between modules, the equations and relations between variables	To implement transport policy measures (individually or in packages) and test the impacts of exogenous scenarios (e.g. population growth)	To analyse the output of the simulations with reference to transport, economic, environmental and social indicators	
$\langle 0 \rangle$			arraunhofer	main TRT

Source: TRT

Figure 2-2: The HOME window

The three sections are independent to each other, thus it is necessary to return back to the HOME screen in order to enter another section. In the upper side of each page you can note the path indicating where you are. In figure 2-2 this is 'HOME'. The current page is in red and bold. You can click on the parent page to move to it. The previous page is also accessible by pressing the Backspace key.

Pressing the Esc key or clicking the Windows close button (the "X" in the upper right corner of the screen) you will exit the application. A dialog box will ask you to confirm your choice. While using the Esc key will quit the ASTRA-EC utility as well, by clicking on the Windows close button will require you to manually exit the utility: right click on the system tray icon and choose the Quit option from the showed menu.

3 Structure: exploring the ASTRA-EC model

3.1 Introduction

This section explains how to use the interface to explore the structure of the ASTRA-EC model.

3.2 **Overview of the ASTRA-EC modules**

The model consists of the following six modules, highlighted in red in the scheme:

- Population
- Transport
- Environment
- Vehicle fleet
- Economy
- Trade

By clicking on the **Structure** button in the HOME screen, you will enter the section of the interface that helps you explore the model's structure and the linkages between modules.

A first overview scheme of the model's structure is presented in the screen (see Figure 3-1).

6



Source: TRT - Fraunhofer-ISI

Figure 3-1: Overview scheme of the linkages between the modules

By clicking on the name of a module, a first scheme of the module's structure will be presented, showing its representative variables and their linkages.

Within each scheme different elements are in turn clickable to go deeper in the model structure. The underlined words in each scheme represent the clickable elements. By clicking on one of these elements another scheme will be opened.

In the following sections each module is briefly introduced, for details the user is referred to Deliverable D4.2 of ASSIST.

3.2.1 Population

By clicking on **Population** in the overview scheme, the Population module is presented (see Figure 3-2).



Source: TRT - Fraunhofer-ISI

Figure 3-2: Scheme of the population module

The population module simulates the demographic development, including information on age structure, gender, household type and income group.

Population results from the trend of fertility rates, death rates and migration balance. The dynamic of income distribution is modelled as dependent on the level of education, the age structure of population, the number of employed and unemployed persons, the development of direct taxes and social contributions.

From the population scheme the following schemes can be accessed:

Table 3-1: Direct links to specific schemes of the population module

Link	Destination scheme
Economy	(Scheme of the Economy module)

3.2.2 Transport

By clicking on **Transport** in the overview scheme, the Transport module is presented (see Figure 3-3).

The transport module deals with the first three stages – generation, distribution and modal split of classical 4-stage transport models both for passenger and freight transport. Transport cost and transport time by mode are the main drivers of the process.



Source: TRT - Fraunhofer-ISI

Figure 3-3: Overview of the transport module

The direct links to specific sub-schemes available from this scheme are reported in the following table:

Link	Destination scheme
Population	(Scheme of the Population module)
Trade	(Scheme of the Foreign trade module)
Economy	(Scheme of the Economy module)
Passenger demand	(Scheme of the passenger sub-module)
Freight demand	(Scheme of the freight sub-module)

Table 3-2: Direct links to specific schemes of the transport module

3.2.2.1 Passenger

By clicking on the **Passenger demand** link in the transport overview scheme, the submodule scheme is shown (see Figure 3-4).



Source: TRT - Fraunhofer-ISI

Figure 3-4: Overview of the passenger transport sub-module

Passenger trip generation is modelled by applying trip rates to several population groups based on age structure and income group.

Passenger trip distribution is the result of a progressive breakdown of generated demand: first between intra-NUTS II and extra-NUTS II trips, then intra-NUTS II trips are divided into local, very short, short trips while Extra-NUTS II trips are split between national, European and intercontinental trips.

The modal split process is calculated separately for each spatial domain (intra-NUTS II local, intra- NUTS II very short, etc.).

The direct links to specific schemes of the module available on the scheme are reported in the following table:

Table 3-3: Direct links to specific schemes of the passenger transport sub-module

Link	Destination scheme
Population	(Scheme of the Population module)

3.2.2.2 Freight

By clicking on the **Freight demand** link in the transport overview scheme, the submodule scheme is shown (Figure 3-5).

Freight transport demand at national and international level is generated on the basis of the value of production and, respectively, of international trade of goods for different sectors.

Freight demand distribution at national level is the result of a progressive breakdown of generated demand (intra-NUTS II and extra-NUTS II). Freight demand distribution at international level depends directly on the trend of country to country trade computed in the trade module.

The simulation of freight modal split is calculated separately for each spatial domain.



Source: TRT - Fraunhofer-ISI

Figure 3-5: Overview of the freight transport sub-module

The direct links to specific schemes of the module available on the scheme are reported in the following table:

 Table 3-4:
 Direct links to specific schemes of the freight transport sub-module

Link	Destination scheme
Trade	(Scheme of the Foreign trade module)
Economy	(Scheme of the Economy module)

3.2.3 Environment

By clicking on **Environment** in the overview scheme, the Environment module is presented (see Figure 3-6).

The Environment module uses input from the transport module (vehicle-kilometrestravelled per mode and geographical context, e.g. NUTS I region or urban areas) and from the vehicle fleet module (technical composition of the vehicle fleets) to compute fuel consumption, greenhouse gas emissions and pollutant emissions from transport, accidents and the related externality value.



Source: TRT - Fraunhofer-ISI

Figure 3-6: Overview of the environment module

The direct links to specific schemes of the module available in the scheme are reported in the following table:

Table 3-5: Direct links to specific schemes of the environmental module

Link	Destination scheme
Vehicle fleet	(Scheme of the Vehicle fleet module)
Transport	(Scheme of the Transport module)

3.2.4 Vehicle fleet

By clicking on **Vehicle fleet** in the overview scheme, the Vehicle fleet module is presented (see Figure 3-7).

The vehicle fleet module simulates the development of the stock of road vehicles in terms of overall size and composition. The most detailed segmentation is modelled for cars (by fuel type and Euro Emission standard), while other road modes – buses, lightduty vehicles and heavy-duty vehicles are more aggregated.



Source: TRT - Fraunhofer-ISI

Figure 3-7: Overview of the vehicle fleet module

The direct links to specific sub-schemes available on the first scheme are reported in the following table:

Table 3-6: Direct links to specific schemes of the vehicle fleet module

Link	Destination scheme
Population	(Scheme of the Population module)
Economy	(Scheme of the Economy module)
Environment	(Scheme of the Environment module)
Transport	(Scheme of the Transport module)
Car Stock	(Scheme of the car sub-module)
Bus Stock	(Scheme of the bus sub-module)
LDV Stock	(Scheme of the LDV sub-module)
HDV Stock	(Scheme of the HDV sub-module)

3.2.4.1 Car

By clicking on the **Car stock** link in the vehicle fleet overview scheme, the sub-module scheme is shown (see Figure 3-8).

The car vehicle fleet module is structured into three sub-models which simulate: the evolution (and ageing) of the car stock, the choice of fuel technology for new cars and the amount of new cars registered.

The evolution of the car stock is a classical stock–flow model: new cars registered constitute the inflow into the car stock which is differentiated by age cohorts, cars are ageing within the stock, and the outflow from the stock represents both scrapping of cars and export of cars outside the EU.

The amount of new registered cars is driven from several input: the most important is the development of average disposable income per adult.

The total new cars registered are allocated to emission standards based on the time and with a certain probability. The choice among the available fuel technologies is modelled on the basis of the Total Cost of Ownership (TCO) and the availability of filling stations.

The direct links to specific schemes of the module available on the scheme are reported in the following table:

 Table 3-7:
 Direct links to specific schemes of the car vehicle fleet sub-module

Link	Destination scheme
Economy	(Scheme of the Economy module)
Population	(Scheme of the Population module)
Environment	(Scheme of the Environment module)



Source: TRT - Fraunhofer-ISI

Figure 3-8: Overview of the car vehicle fleet sub-module

3.2.4.2 Bus

By clicking on the **Bus stock** link in the vehicle fleet overview scheme, the sub-module scheme is shown (see Figure 3-9).

The bus fleet module calculates the number of buses used in EU depending on the traffic demand. The major assumption is that rationality of bus operators will lead to an optimal number of buses to satisfy the demand.

Each new bus is classified to an emission standard according to the year of registration. The bus fleet is feed by new purchased busses and diminished by scrapped buses.



Source: TRT - Fraunhofer-ISI

Figure 3-9: Overview of the bus vehicle fleet sub-module

The direct links to specific schemes of the module available on the scheme are reported in the following table:

Table 3-8: Direct links to specific schemes of the bus vehicle fleet sub-module

Link	Destination scheme
Transport	(Scheme of the Transport module)
Environment	(Scheme of the Environment module)

3.2.4.3 LDV

By clicking on the **LDV stock** link in the vehicle fleet overview scheme the sub-module scheme is shown (see Figure 3-10).

The LDV fleet module calculates the number of light duty vehicles (total weight of less than 3,5t) depending on transport demand: the number of existing vehicles multiplied with an annual vehicle mileage leads to the status quo transport supply.

The choice of alternative powertrain technologies is based on the total cost of ownership (TCO), while the classification by emission standard is estimated according to the year of registration.





Source: TRT - Fraunhofer-ISI

Figure 3-10: Overview of the LDV vehicle fleet sub-module

The direct links to specific schemes of the module available on the scheme are reported in the following table:

Table 3-9:	Direct links to specific schemes of the LDV vehicle fleet sub-module
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Link	Destination scheme
Transport	(Scheme of the Transport module)
Economy	(Scheme of the Economy module)
Environment	(Scheme of the Environment module)

3.2.4.4 HDV

By clicking on the **HDV stock** link in the vehicle fleet overview scheme, the sub-module scheme is shown (see Figure 3-11).

The HDV fleet module divides the fleet into vehicles with a total weight above and below 12t. The demand for each vehicle class depends on the segmented traffic demand in vehicle-km coming from the transport module: the number of existing vehicles multiplied with an annual vehicle mileage leads to the status quo transport supply.

The classification by emission standard is estimated according to the year of registration; the HDV fleet is feed by new purchased vehicles and diminished by scrappage.



Source: TRT - Fraunhofer-ISI

Figure 3-11: Overview of the HDV vehicle fleet sub-module

The direct links to specific schemes of the module available on the scheme are reported in the following table:

Table 3-10: Direct links to specific schemes of the HDV vehicle fleet sub-module

Link	Destination scheme
Transport	(Scheme of the Transport module)
Environment	(Scheme of the Environment module)

3.2.5 Economy

By clicking on **Economy** in the overview scheme, the Economic module is presented (see Figure 3-12).

The economic module consists of various elements: economic interactions between economic sectors (input-output), GDP, employment as well as the major components of final demand: consumption, investments and the government consumption.



Source: TRT - Fraunhofer-ISI

Figure 3-12: Overview of the economic module

The direct links to specific schemes of the module available on the scheme are reported in the following table:

Link	Destination scheme
Trade	(Scheme of the Foreign trade module)
Transport	(Scheme of the Transport module)
Population	(Scheme of the Population module)

Table 3-11: Direct links to specific schemes of the economic module

3.2.6 Foreign trade

By clicking on **Trade** in the overview scheme, the Foreign trade module is presented (see Figure 3-13).

The trade module includes two parts: one for intra-EU trade and the other for EU to rest-of-the-world (RoW) trade. The intra-EU trade is modelled as dependent on exogenous as well as endogenous factors provided by the transport and economic modules: transport cost, productivity, GDP growth. The EU-RoW trade model is mainly driven by relative productivity between the European countries and the rest-of-the-world regions.



Source: TRT - Fraunhofer-ISI

Figure 3-13: Overview of the foreign trade module

The direct links to specific schemes of the module available on the scheme are reported in the following table:

Table 3-12: Direct links to specific schemes of the foreign trade module

Link	Destination scheme	
Transport	(Scheme of the Transport module)	
Economy	(Scheme of the Economy module)	

4 Simulation: running the ASTRA-EC model

4.1 Introduction

This section explains how to use the interface to run the ASTRA-EC model and simulate policy scenarios. The structure of this section is the following. Section 4.2 explains how to run the reference scenario. Section 4.3 illustrates how policy measures can be activated and combined to arrange policy scenarios. In section 4.4 how to modify exogenous assumptions used by the model is explained. Finally section 4.5 shows how to use external trends, e.g. drawn from other models.

By clicking the **Simulation** button in the HOME screen, you will enter the section of the Interface that allows you to implement transport policy measures (individually or in packages) and test the impacts of exogenous assumptions (e.g. population growth).

Mo	odify policy options			
⇒ Pri	cing		33	Efficiency standards & Flanking Measures
>> Ta	xation			Transport Planning
>> Infr	rastructure (Transport & Inform	Information/Communication)		Research and Innovation & Other
>> Inte	ernal Markets			
Puel pric P Emission P External	le trend n factors by vehicle type thy cost	PREPARE ADD DATA PREPARE ADD DATA Poliklant emissions and accidents CO2 emissions (eurotom)		Ряелиле Або ДАТА 85 25 1 5905 2,050
	1.075 . 00			

Source: TRT

Figure 4-1: The SIMULATION screen

The SIMULATION screen (see Figure 4-1) is divided into three sections, called:

- Modify policy options
- Change exogenous alternative assumptions
- External trends

In addition, three buttons are situated at the bottom of the page. They aim at:

- simulating the scenario and saving the results for a selected set of variables;
- simulating the scenario and saving the results for all variables every 5 years;

• going back to the HOME page without any new simulation. By clicking **Cancel**, all settings done so far will be deleted.

4.2 Run the reference scenario

You can run a reference scenario without modifying any setting. To do that, click the **Simulate with savelist** button or the **Simulate without savelist** one.

A *savelist* is a set of variables listed in an exogenous file for which the model will save the results.

The option "simulate with savelist" uses a predefined savelist (included in the "ASTRA-EC_model_interface.vpa" file). This option is highly recommended. If a savelist is not used, the model will save the results of all variables, thus creating a very large database. Since the modelling output accessible from the Interface is predefined, there is no benefit choosing to run the model without savelist. This option is included basically for allowing experienced model users debugging results when exploring the model without the Interface.

At the end of the simulation you will be automatically moved to the OUTPUT page (see chapter 5).

4.3 Modify policy options and run policy scenarios

Seven domains of policies are listed in this frame of the screen. By clicking the >> button a specific screen for the chosen policy domain is opened and the policy measures available in that domain can be set.

The seven main domains of policies are:

- Pricing
- Taxation
- Infrastructure (Transport & Information/Communication)
- Internal Markets
- Efficiency standards & Flanking Measures
- Transport Planning
- Research and Innovation & Other

The next section 4.3.1 explains the procedure to run a scenario with one or more policies activated. Table 4-1 in section 4.3.2 reports the inputs for TPM simulation. The content and the meaning in modelling terms of all policy measures is explained in Annex 4.

4.3.1 Policy measure screen

The POLICY MEASURES screen is different according to the domain selected, but their general structure looks like the one in Figure 4-2 and include the following sections:

ii51			
Pucture Charging / Restrictions Schemes	Ubbeninged user charging / access restrictions	Year of implementation	
	Car road charging schemes		
	Y	Year of implementation	
	Railway infrastructure charges directive (2001/14/EC	C)	
	Passanger	Year of implementation	C PREPARE ADD DATA
	Treight	Year of implementation	10 2013 2010 2012 PREPARE ADD LATA 2013 2014 2012 C ADD LATA

Source: TRT

Figure 4-2: Layout of a POLICY MEASURE screen

- 1. Your localization and the links to the parent directories (the HOME and the SIMULATION screen).
- 2. Policy measures available and the controls to set and activate them. When for a policy domain there are several measures available, the controls for set and activate them are stored in more pages. In that case at the bottom of this frame there is a button to move on the next page regarding the same policy domain.
- 3. The **Other policies** button to manage the definition of policy bundles using measures from different domains.
- 4. Buttons to run the scenario simulation.

5. The **Reset** button to return all inputs of the screen to the reference model settings¹.

4.3.1.1 Activate one policy measure



Figure 4-3: Example of policy measure activation

In order to activate a specific policy measure, the following steps are needed:

- a) Flag the selected policy by clicking in the checkbox corresponding to the policy title (see Figure 4-3, arrow a)
- b) Set the implementation year by moving the slider or typing the year in the window (see Figure 4-3, arrow b)
- c) If available, define the value to apply for the simulation. In the more general case this can be done in two alternative ways:

Detailed implementation:

- click on the upper radio button (see Figure 4-3, arrow c1) to select the detailed implementation
- click on the **Prepare** button: an external excel file (see Figure 4-4 and Figure 4-5) is opened, where all the available combinations for setting the policy content (e.g. a charge by country and fuel type) are listed on the vertical axis and the simulation years are listed on the horizontal axis. You can change any value (e.g. setting different charges by country and/or decreasing charges over time. Note that the modification of any value written in this file related to years before the implementation year defined in step b is not blocked). Once you have made the intended

¹ Note: Due to a bug of the Vensim application, the **Reset** button will not affect the sliders, that have to be manually scrolled to the original value.
modifications export them as ".tab" file by clicking the **Create** button on any sheet of the file; that ".tab" file will automatically be converted to a ".vdf" format with the same name.

- click on the **Add data** button. You will be asked to select the ".vdf" file just produced which will be used for the scenario.

Simple implementation:

- click on the lower radio button (see Figure 4-3, arrow c2) to select the simple implementation
- choose a value by dragging the slider: the value will be applied from the year of implementation until the end of the simulation period for all the available combinations (e.g. for all countries, all vehicle types, etc.).

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Figure 4-4: An external excel file – main sheet

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18 DE6 - Hamburg	0	0		0	0		0 0	0 0	0	0	0	0	0	0	0	0		0 0	0	(1	9 6	0
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23 DEB - Rheinland-Pfalz	0	0		0	0		0 0	0 0	0	0	0	0	0	0	0 0	0		0 0	0			1 0	0
24 DEC - Searland	0	0		0	0		0	0 0	0	0	(0	0	0	0	0		0 0	0			1 0	0
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27 DEF - Schleswig-Holstein	0	0		0	0		0	0 0	0	0	(0	0	0	0 0	0		0 0	0			1 0	0
28 DEG - Thüringen	0	0		0	0		0 0	0 0	0	0	(0	0	0	0 0	0		0 0	0	(/ 0	0
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31 GR1 - Voreia Ellada	0	0		0	0		0 (0 0	0	0		0	0	0	0 0	0		0 0	0		1	1 0	0
32 GR2 - Kentriki Ellada	0	0	0	0	0		0 (0 0	0	0		0	0	0	0 0	0		0 0	0				0
33 GR3-Attini	0	0		0	0		0 0	0 0	0	0		0	0	0	0	0		0 0	0				5
34 GR4 - Nisla Algalou, Rriti	0	0		0	0		0 (0 0	0	0	(0	0	0	0	0		0 0	0		-		5
35 ESI - Nordeste	0	0	0	0	0		0 (0 0	0	0	(0	0	0	0	0		0 0	0	0			3
30 ES2 - Noreste	0	0		0	0	-	0	0 0	0	0		0	0	0	0	0		0 0	0		-	4	9
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Source: TRT

Figure 4-5: An external excel file – a "variable" sheet

4.3.1.2 Run a scenario with just one policy measure

If you want to simulate a policy scenario with just one measure, after the definition of the policy input click the **Simulate with savelist** button or the **Simulate without savelist** button. A dialog window is opened where you are asked to choose a name for the output file and a directory where the output file will be saved.

You can just choose a file name for the output file without changing the directory proposed by default. If you do it this way the output dataset will be saved in the main directory of ASTRA-EC. This means that when you want to load a specific output dataset (see section 4) you will have to find it from the list of files stored there. Another option might be to create a specific directory where to save the output datasets.

Once you have defined this option the simulation will start.

At the end of the simulation you will be automatically moved to the OUTPUT page (see chapter 5).

4.3.1.3 Build and run a package of measures for a policy scenario

In several cases you may want to simulate a policy scenario including more measures. The process is just to activate all the measures you want to include in the package. From the SIMULATION screen you can enter in the page of the first policy domain from which you want activate policy measures.

Activate and set all measures you want to include in the package following the steps explained in the section 4.3.1.1 above. Remember that usually for each domain more pages of measures are available, use the **Next policies** button to access all the measures within one domain.

Once all the measures you want to include from the first domain are set you can switch to another domain by clicking the **Other policies** button. You will be moved to the SIMULATION screen from which you can enter in another policy domain and set up other measures.

You can select measures from any domain you want: all changes will be kept in memory until the scenario is run or the **Cancel** button is clicked. The **Reset** button in any POLICY MEASURES screen will reset the values of that screen, while the settings done so far for the previous policies will be kept in memory.

Once you have finished to set all measures, in order to run the policy scenario you have to click the **Simulate with savelist** button or the **Simulate without savelist** button (as explained in section 4.3.1.2).

4.3.2 Summary of policy implementation

Table 4-1: Inputs for TPM simulation with the ASTRA-EC interface

TPM category	ТРМ	Input	Unit	Type of input
PRICING	Urban road user charging / access restrictions	Charge applied to private cars for entering in urban areas	Euro / trip	Exogenous file or slider
	Car road charging schemes	Charge applied to car vehicles for the use of the motorway road network	Euro / vkm	Exogenous file or slider
	Railway infrastructure charges directive	Charge applied to train operators for the use of the rail infrastructure	Euro / train	Exogenous file or slider
	EUROVIGNETTE' Di- rective / road charging heavy-duty vehicles	Charge applied to truck vehicles for the use of the motorway road network	Euro / vkm	Exogenous file or slider
	Internalisation of external costs for specific modes of transport (road, rail, iww, ports, airports)	Charge applied on specif- ic modes to internalise external costs	Euro / vkm	Exogenous file
TAXATION	Energy Taxation	Fuel/energy tax by fuel/energy product	Euro / I (kg or kWh)	Exogenous file
	Vehicle taxation (circula- tion & registration)	Vehicle taxation by car category	Euro / vehicle	Exogenous file
	CO2 certificate		Euro / ton of CO ₂	Slider
	Feebates	Extra-cost or discount added to price of cars depending on technology	Euro / vehicle	Exogenous file
INFRASTRUC TURE	TEN-T projects accelerat- ed implementation	Reduction of travel time by mode depending on the timing of the TEN-T investments	n.a.	On / off switch
	Improving frequency and reliability of public transport service	Reduction of travel time by bus and train at local level	n.a.	On / off switch
INTERNAL MARKET	EU-wide common job quality and working condi- tions for truck drivers	Increment of truck travel time and truck driver la- bour cost for long dis- tance trips	n.a.	On / off switch
	Elimination of restrictions on cabotage	Reduction of truck driver labour cost and of the share of empty trips	n.a.	On / off switch

TPM category	ТРМ	Input	Unit	Type of input
	Opening of the domestic rail passenger market; Community railway liber- alisation	Reduction of rail passen- ger user cost and train travel time for long dis- tance trips	n.a.	On / off switch
	Stimulate the integration of inland waterways into the transport system (RIS integrated with eFreight and eCustoms)	Reduction of travel time by IWW at international level	n.a.	On / off switch
	Simplification of formali- ties for ships travelling between EU ports ("Blue Belt")	Reduction of time in port for maritime mode and of ship non fuel cost	n.a.	On / off switch
	Implementation of the Single European Sky Initiative - SESAR	Reduction of time at the airport, non-fuel cost and increased fuel efficiency during take-off and land- ing	n.a.	On / off switch
EFFICIENCY	CO2 emission limits for HDV, LDV, cars etc	Improvement of fuel effi- ciency of new vehicles	n.a.	On / off switch
	Standards for controlling air pollution (CO, NOx, particulate matter)	Improvement of pollutant emission factors of vehi- cles of new standard	n.a.	On / off switch
TRANSPORT PLANNING	Promotion of energy effi- ciency commercial vehi- cles (delivery vans, taxis, buses)	Reduction of average fuel consumption of LDVs and buses at local level and increased share of electric LDV in the fleet	n.a.	On / off switch
	City logistic / Urban freight distribution / Urban con- solidation center etc.	Increment of the average load factor of LDVs (and slightly HDVs)	n.a.	On / off switch
RESEARCH	Electromobility Road	Increasing user prefer- ence, additional R&D investments, reduction of car prices due to learning	n.a.	On / off switch
	H2 Fuel Cell vehicles	Increasing user prefer- ence, additional R&D investments, reduction of car prices due to learning	n.a.	On / off switch
	Compulsory safety stand- ards in road vehicles (Driver assistance sys- tems, seat belt reminder, eCall, vehicle- infrastructure interface)	Reduction of the accident rates for cars and trucks	n.a.	On / off switch

TPM category	ТРМ	Input	Unit	Type of input
	Increased replacement rate of inefficient and polluting vehicles			On / off switch

Source: TRT / Fraunhofer-ISI

4.4 Change exogenous assumptions

The second frame of the SIMULATION screen allows you to change assumptions regarding some key exogenous trends or factors (see Figure 4-6):

- Resource fuel price trend
- Emission factors by vehicle type
- External costs of CO2, pollutant emissions and accidents.

Modify policy options		
Pricing		Efficiency standards & Flanking Measures
>> Taxation		Transport Planning
>> Infrastructure (Transport & Inform	ation/Communication)	Research and Innevation & Other
Internal Markets		
Change exogenous alterna	tive assumptions	
Fuel price trend Fuel price	PREPARE ADD DATA	
Emission factors by vehicle type	PREPARE ADD DATA	12 July 14
Eidemality cost	Pollutant emissions and accidents CO2 emissions (euro/torn)	PREPARE ADD DATA
		25

Source: TRT

Figure 4-6: The SIMULATION screen: change of exogenous assumptions

4.4.1 Change resource fuel price trend

The model uses exogenous data about the trend of resource fuel price (i.e. price before taxes). Data is differentiated by country and fuel:

- Diesel
- Gasoline
- LPG
- CNG
- Biodiesel
- Bioethanol
- Electricity
- Hydrogen.

If you want to test the effect of different fuel prices, you can change the exogenous dataset. The procedure is the same used to implement a policy measure in a detailed form:

- · click on the checkbox to select the fuel price trend
- click on the Prepare button: an external excel file (see section 4.3.1.1) is opened where you can change any value. Once you have made the intended modifications click the Create button
- click on the **Add data** button. You will be asked to select the ".vdf" file just produced which will be used for the scenario.

4.4.2 Change emission factors

In order to compute polluting transport emissions the model uses a set of emissions factors (in g/vkm) taken from several data sources² (e.g. HBEFA 3.1, MEET, etc.). If you want to change this set with a different one you can do it by using the same procedure explained above:

- · click on the checkbox to select the emissions factors
- click the **Prepare** button: an external excel file (see section 4.3.1.1) will be opened where you can change any value. Once you have made the intended modifications click the **Create** button

² see Deliverable D4.2 (chapter 8) for more information

• click on the **Add data** button. You will be asked to select the ".vdf" file just produced which will be used for the scenario.

The variables are differentiated by mode and pollutant, with the level of detail reported in the following table.

Mode	Vehicle	Distance band	Pollutant
Car	By car category and emission standard	Urban, non-urban, long	CO, VOC, NOx, PM
Bus	Emission standard	Urban, non-urban, long	CO, VOC, NOx, PM
Passenger Train	Diesel or electric	Urban, non-urban, long	CO, VOC, NOx, PM
Airplane	-	-	CO, VOC, NOx
HDV	Emission standard	Urban, non-urban, long	CO, VOC, NOx, PM
LDV	Emission standard	Urban, non-urban, long	CO, VOC, NOx, PM
Freight Train	Diesel or electric	-	CO, VOC, NOx, PM
Ship	-	-	CO, VOC, NOx, PM, SO2
IWW	-	-	CO, VOC, NOx, PM, SO2

Table 4-2:Segmentation of emission factors by mode and pollutant

4.4.3 Change marginal external costs

In order to estimate the external costs of transport, the model uses a set of marginal external costs (in Euro/tonne or Euro/individual) taken from the deliverable D1 of the IMPACT project³. If you want to change this set with a different one you can do it here.

For the marginal cost of polluting emissions of accidents, the procedure is the same explained above:

· click on the checkbox to select the external costs

³ "Handbook on estimation of external costs in the transport sector - Internalisation Measures and Policies for All external Cost of Transport", IMPACT project D1, CE Delft, 2008

- click the Prepare button: an external excel file (see section 4.3.1.1) will be opened where you can change any value. Once you have made the intended modifications click the Create button
- click on the **Add data** button. You will be asked to select the ".vdf" file just produced which will be used for the scenario.

The variables are differentiated by pollutant and country (and distance band where relevant), with the level of detail reported in the following table.

 Table 4-3:
 Segmentation of external costs of pollutant emissions and accidents

Externality	Country	Distance band
PM emissions	country	Urban, non-urban
NOx, VOC, SO2 emissions	country	-
Accidents	-	-

The marginal external cost of CO2 is set up through a special dialog window, called Graph Lookup Editor.

A Lookup is special variable whose value (output) is defined as a function of another variable (input). The user can define the output values corresponding to a set of input values. The program automatically interpolates to calculate the output values for all intermediate points

In order to call the Graph Lookup Editor click on the stylised graph in the SIMULATION screen (see Figure 4-7).

	Modify policy options			
35	Pricing		35	Efficiency standards & Flanking Measures
33	Taxation		>>	Transport Planning
33	Infrastructure (Transport & Information/	Communication)	>>	Research and Innovation & Other
33	Internal Markets			
? ? ?	mission factors by vehicle type	PREPARE ADD DATA Pollutant emissions and accidents CO2 emissions (eurotonn)	(PREFINAE ACCIDATA 86 29 29 29 20 20 50 50 50 50 50 50 50 50 50 50 50 50 50

Source: TRT

Figure 4-7: The simulation screen: activation of the Graph Lookup Editor.



Figure 4-8: Layout of the Graph Lookup Editor

The dialog windows of the Graph Lookup Editor is shown in Figure 4-8. There are many controls in this dialog windows, but you need to use only the "input" and "output" cells and the **Clear Points** button.

When the Editor is opened predefined values are already coded. These predefined values show which is the marginal external cost of one tonne of CO2 at various years (e.g. at the year 1995 the marginal cost is 25 Euro/tonne, at the year 2030 is 55 Euro/tonne, etc.). If you want to change these values simply type under input the years for which you want to include a new value and in the corresponding Output cell the value you want to include. If the predefined list of years is fine you can change the values in the column Output. There is no limit to the number of pairs.

The Input/Output pairs are always shown in ascending order. Because of this, entering a new x-value can cause things to jump around.

To remove or delete a point, you need to use the <u>Clear Points</u> button:

- First click on the Clear Points button (which will be automatically renamed Add Points),
- then click on the graph on the points you want to delete.

Clear All Points clears all the points in the Lookup. This is useful if you want to start over.

4.5 Activate external trends

The third frame of the SIMULATION screen allows you to activate input from external sources (see Figure 4-9).

Four different types of input from external sources can be activated:

- Linkage with TRANS-TOOLS
- Exogenous GDP trend
- Exogenous population trend
- Linkage with POLES.

It's important to note that, with the implementation of these trends, some of the feedback loops of the model are not activated (therefore some results might not be sensitive to the measures simulated). For instance, when fuel costs increases expenditure for transport tends to increase and the income available for non-transport consumption is reduced, with a negative effect on aggregate demand and on GDP. If an exogenous GDP is used, this feed-back loop will not work and GDP will not change at all if higher fuel prices are simulated.

mouny poncy options		
Pricing		Efficiency standards & Flanking Measures
>>> Taxation		>>> Transport Planning
>>> Infrastructure (Transport & Infr	ormation/Communication)	Research and Innovation & Other
>> Internal Markets		
Emission factors by vehicle type	PREPARE ADD DATA Pollutart emissions and accidents CO2 emissions (eurofrom)	риелиле Аро Дита 85
		2000

Source: TRT

Figure 4-9: The SIMULATION screen: activate input from external sources

4.5.1 Activating the linkage with TRANSTOOLS model

By clicking on the **External trends** link in the SIMULATION screen you will be moved to the OTHER INPUTS screen, shown in Figure 4-10.

The ASTRA-EC model uses an endogenous trend of transport cost and time and provides a transport demand trend. If, for any reason, you want ASTRA-EC to use the same cost and time trend as in TRANS-TOOLS and/or even the same transport demand trend, you can activate this soft linkage here.

As mentioned above the linkage can be implemented in twofold way:

- Variation of transport cost and transport time are implemented in ASTRA-EC on the basis of TRANS-TOOLS output; nevertheless, the evolution of transport demand is endogenously estimated in ASTRA-EC.
- Variation of transport cost, transport time and also trips by mode are implemented in ASTRA-EC on the basis of TRANS-TOOLS output; in this case, some feedbacks on transport demand are not activated.

INTER / SMULATION / OTHER INF	UTS	
With the implementation of these trends some of the fee	backs of the model are not activated (therefore some results might not be sensitive)	
Linkage with TRANS-TOOLS	C NO	
	C Trend of time and cost by mode	
	?	PREPARE ADD DATA
	C Trend of transport demand by mode and trend of time and cost by mode	
	7	PREPARE ADD DATA
Exogenous GDP trend	Thend of GDP by country	
	2	PREPARE ADD DATA
Exogenous population trend	Trend of population	
	7	PREPARE ADD DATA
Linkage with POLES	Fuel prices and energy shares	
	7	PREPARE ADD DATA

Source: TRT

Figure 4-10: The OTHER INPUTS screen

The user can decide the type of linkage to be activated by selecting the option and following the two steps of preparation of exogenous data as in paragraph 4.3.1.1:

- click on the radio button to activate the preferred type of linkage
- click the Prepare button: an external excel file (see section 4.3.1.1) will be opened where you can change any value. Once you have made the intended modifications click the Create button
- click on the **Add data** button. You are asked to select the ".vdf" file just produced which will be used for the scenario.

4.5.2 Implementing an exogenous trend of GDP

The ASTRA-EC model provides an endogenous GDP trend. If, for any reason, you want ASTRA-EC to use an external pre-defined trend of GDP you can activate this option here. Remember that in this case the feedback loops on macro-economic module are not activated.

The user can implement exogenous GDP trend according to the following steps:

· click on the checkbox to activate the linkage

- click the Prepare button: an external excel file (see section 4.3.1.1) will be opened where you can change any value. Once you made the intended modifications click the Create button
- click on the **Add data** button. You are asked to select the ".vdf" file just produced which will be used for the scenario.

4.5.3 Implementing an exogenous population trend

The ASTRA-EC model provides an endogenous population trend. If, for any reason, you want ASTRA-EC to use an external pre-defined trend of population you can activate this option here.

The user can implement exogenous population data according to the following steps:

- click on the checkbox to activate the linkage
- click the **Prepare** button: an external excel file (see section 4.3.1.1) will be opened where you can change any value. Once you have made the intended modifications click the **Create** button
- click on the **Add data** button. You will be asked to select the ".vdf" file just produced which will be used for the scenario.

4.5.4 Activating the linkage with POLES model

The ASTRA-EC model uses exogenous input regarding resource fuel prices and nontransport energy demand. If a scenario is simulated with the POLES model where these elements change and you want to use these new set of results in ASTRA-EC you can do it from here.

The user can activate the exogenous POLES trends by following the below described steps:

- click on the checkbox to activate the linkage
- click the **Prepare** button: an external excel file (see section 4.3.1.1) will be opened where you can change any value. Once you have made the intended modifications click the **Create** button

• click on the **Add data** button. You will be asked to select the ".vdf" file just produced which will be used for the scenario.

5 Output: reading results

5.1 Introduction

This section explains how to use the interface to read the results of the scenarios simulated by the ASTRA-EC model. The structure of this section is the following. Section 5.2 explains how to load a scenario dataset whee the results of a simulation are stored. Section 5.3 illustrates how to visualise results either in tabular or in graphical form and how to compare different scenarios. Finally section 5.4 shows how to check if the expected policy changes have been actually applied in a scenario.

By clicking the **Output** button in the HOME screen, you enter the section of the interface that shows the output of the main indicators that characterize a scenario (see Figure 5-1).



Source: TRT

Figure 5-1: The OUTPUT screen for the visualization of the simulation results

This screen includes four parts:

- 1. Your localization and the links to the parent directories (the HOME screen).
- 2. Two buttons which manage utilities to analyse modelling results:

By clicking the **Export all indicators** button you can export the results of a scenario dataset in .tab format to analyse data with external software. A dialog window will

open and ask you for the dataset (a ".vdf" file) you want to export.; you will then be asked to provide the filename and the directory where the file in .tab format will be saved. All variables saved for the selected dataset (according to the use or not of the savelist) will be exported. This may require some time (usually less than one minute, it is depending on the hardware system).

By clicking the **Verify policy changes** button, you can check the main input used to run different scenarios: therefore you are moved to the screen described in section 5.4.

- 3. Five main buttons, each related to a different result group to access the indicators screens.
- 4. A box where active datasets of modelling results are listed and a button to load other datasets or unload some active databases.

5.2 Loading results datasets

The first step to see the modelling results is to load one or more datasets. At least one dataset must be loaded if you want to see results.

If you access the OUTPUT screen just after running a scenario, the dataset of that scenario is already loaded and you can see its name in the dataset box.

If you want to <u>compare the result of different scenarios</u>, you can click the **Change** button. The Dataset Control Dialog window (Figure 5-2) will appear allowing you to select the desired datasets (each dataset has the name the you chose when running the scenario: see section 4.3.1.2)

Dataset C	ontrol			
Availab	le - Info		Loaded - Info	
ASTRA ASTRA-i ENV-EV FOT_EV FOT_IV LDV_IV2 LDV_IV3 MAC_con	_ENV_inpl Anput	» «	ASTRA_EC_Sc_Re	fere
	1_1*		Load From	
D	elete		Close	

Figure 5-2: Dataset Control Dialog window

In the left section of the Dataset Control Dialog window you will see a list of datasets, available into the working directory. This list includes scenario datasets generated when running the model. If you have saved these datasets in the same directory where ASTRA-EC is installed (which is the default directory proposed by the dialog window when you are asked to choose a name for the dataset of results, see section 4.3.1.2) the list includes also the input files of the policies you have set. You can choose to visualize any dataset but only scenario output datasets include the values for all the indicators of the interface; therefore the other datasets should be disregarded.

In order to load a scenario output dataset, select it from the list in the left section and click the >> button. The selected dataset will be added to the list in the right side of the window.

In case the output dataset you want to load is not present in the list because it is saved in a different directory, you can access it by clicking the **Load From...** button. From the new window you can browse your directories, locate the needed file and load it.

In order to unload a scenario select it from the list in the right section click the << button.

The order of the selected datasets can be changed by clicking on the items of the right side box: by clicking on an element, that will be automatically placed at the top of the list.

You can load any number of datasets, but keep in mind that the more dataset you have, the more numbers will be displayed in the output tables and the more lines will be displayed in the output graphs. Especially the latter can become hard to read if too many output datasets are loaded.

When you have selected the desired dataset(s) exit the Dataset Control Dialog window by clicking the **Close** button.

5.3 Look at scenario results and compare scenarios

In the central part of the OUTPUT screen five buttons allow you to select which results of the loaded scenario(s) you want to see. The five indicators groups you can choose are:

- Key indicators
- Transport
- Economic
- Environmental
- Social

5.3.1 Looking at key indicators

Clicking the **Key indicators** button, the KEY INDICATORS screen is opened (see Figure 5-3). This screen includes five major indicators which allow you to have a quick glance of the impacts of the policy scenario(s) on transport, environment, economy and society at EU level. The five key indicators are:

- Car passenger transport activity
- Truck freight transport activity
- GDP
- CO2 transport emissions (tank-to-wheel)
- Employment.

🖁 ASSIST - ASsessing the Social and economic Impacts of past and future Sustainable Transport policy in Europe							_ 0 _ X
		8		_		9	
7SS 2 EU2/ EU15 EU12 Country		Jable Graph	Var. from Ret. Scenario			Elisioni	PRIN
Carry anger transport activity by origin country 1 3 cr - 774 _raxe, Vawly_ Origin_sico_fee_Mode_ner_Country	>>	Time (Year) "TR 1 mass Yearly Origin TR 7 Yearly Origin (1996 pkm per Mode per (okm per Mode per C	1997 Country[Car,Cour ountry	1998 (ny]" Ruas:	1999 ASTRA EC	2000 Sc Reference
Truck freight transport activity by origin country No Temysor- TRA the Yoany Copin film, per Mode, per Country		[Car,DC] [Car,DK]	62,462 96,626 46,323	63,234 98,142 46,943	64,370 99,630 47,531	65,678 101,086 47,964	67,077 102,747 48,353
GDP Nin Firm/year-MAC_ptp_Grass_Planetile_Preduct	- 20	[Car,FS] Car,FT] [Car,FR]	247,793 52,854 638,958	258,216 54,134 651,692	269,221 55,672 663,234	280,289 57,390 676,334	291,783 59,207 691,705
CO2 transport emissions (tarik-to-wheel) ona/year - L/W-/enk_lo_Wheel_Yeanly_emicarons_per_L.C		Car,UK] [Car,DE] [Car,EL]	615,139 816,361 56,492	618,377 822,908 58,635	620,135 828,315 60,595	621,248 835,518 62,762	621,148 844,289 64,771
Employment Poss - MAC_comp_Finployment_per_Country		[Car,II] [Car,II] [Car,NL] Car,NL]	32,332 617,385 124,386 61,742	.33,719 629,936 126,854 63,934	35,368 645,012 129,498 66,275	.37,181 660,868 131,840 68,904	38,792 675,611 133,984 71,228
		Car,SE] [Car,BG] [Car,CH]	87,945 25,442 74,309	89,028 25,871	90,058 26,149 76,260	91,247 26,460	92,625 26,903
		[Car,CY] [Car,CZ] [Car,EE]	3,094 50,858 5,625	3,174 52,778 5 744	3,257 54,604 5,836	3,343 56,427 5,927	3,441 58,220 6.067
		Car,HU] Car,LV] Car,LT]	45,727 8,386 17,650	46,320 8,728 18,234	46,851 9,089 19.040	47,392 9,506 20.061	48,003 10,009 21,326
		[Car,M1] [Car,N0] [Car,PL]	1,411 47,462 135,599	1,447 48,850 143,002	1,486 50,365 151,250	1,524 51,647 160,661	1,561 52,511 170,683
		[Car,RO] [Car,SI] [Car,SK]	44,254 17,802 16,640	46,261 18,413 17,359	48,223 19,035 17,998	50,359 19,561 18,789	52,859 20,135 19,984
Change III an PC2 ANY	800 6	[Car,LU]	4,377	4,539	4,698	4,871	5,055

Source: TRT

Figure 5-3: Layout of the KEY INDICATORS screen

The KEY INDICATORS screen has the following sections (numbers refer to those shown in Figure 5-3):

- 1. Your localization and the links to the parent directories (the HOME and the OUTPUT screens).
- 2. A group of buttons to change the level of spatial aggregation for the indicators shown. You can choose one of the following:
 - o EU27
 - o EU15
 - o EU12
 - o Country
- 3. A list of indicators for which you can see the values. By clicking on the >> button at the side of each indicator you select the relative variable of the model and its valus are shown in the window of section 7.
- 4. A group of buttons to select the subscripts for which you want to see the results. For instance, you might want to display the results for some countries or some modes, etc. (the subscripts available depend on the specific variable). By clicking on a button of this group, a dialog window will pop-up. See paragraph 5.3.1.1 for the description of its usage.
- 5. A group of buttons to move from one indicators group to another.

- 6. The list of the loaded scenarios datasets and a button to load and unload datasets (see section 5.2).
- 7. The window where the values of the selected indicator for the selected scenario datasets and the selected subscripts are shown as Table or Graph.
- 8. Two buttons to switch to the graphical representation of the outputs if you are looking at the tabular one and vice-versa. By default when you access the INDICATORS screen results will be initially shown in tabular. Click on the **Graph** button to display linear graphs and click on the **Table** button to show numbers. Keep in mind that the graph format is helpful when you have a limited number of cases to show, otherwise the graphs are hard to read. Also, no more than 16 different lines can be shown in a graph. The program will output a message in case you try to show more lines.
- 9. Two buttons to export or print the results shown in the window.
 - If you want to copy the content of the window into the clipboard to paste it in an external application just click on the **Export** button. If the Table representation is active, the data will be copied in text format that you can paste for example in an Excel file. If the Graph representation is active, the content of the window will be copied as an image (that you can paste into a Word document, for example).
 - If you want to print the content of the window, click on the **Print** button and the printer dialog window is opened.

5.3.1.1 Select Subscript

Section 4 of the indicators screen contains a group of buttons that allow to choose for which zones and modes to analyse the selected variable.

By clicking one of the these buttons a dialog window will be opened, showing the elements of the corresponding subscripts range. Depending on the definition of subranges, the dialog window can be like the one shown on Figure 5-4 or the one shown on Figure 5-5.

On the first type of dialog window the subscripts elements are listed and highlighted if selected. Just click on one of them to select/unselect in order to view/hide the relative variable's value.

Select for FreightModeOut	out
truck freightTrain	
maritime	
IWW	
All None	Close

Figure 5-4: Dialog window for the selection of zones or modes without subranges

For some subscripts ranges, one or more sub-ranges were defined to ease the management of the variable during both the equation's editing and the outcomes analysis. For example, the subscripts range "Country" presents the sub-ranges "EU27", "EU15", "EU12" (among others) to allow a quick selection of the countries related to each European aggregations. The layout of the dialog window for the selection of such subscripts is shown in Figure 5-5. The three numbered areas represent:

- 1. the elements of the subscripts range
- 2. the selected elements for which the variable's data will be shown
- 3. the sub-ranges available for a quick multiple selection of the corresponding elements

The << and >> buttons between the sections 1 and 2 allow to exchange the elements between the two boxes: by clicking on an element of the section 1 and later on the >> button the element will be included among the selected ones in section 2; viceversa, by clicking on an element of section 2 and later on the << button the element will be removed from the list and the related variable's data won't be shown.





5.3.1.2 Looking at differences with respect to Reference Scenario

You can look at the differences between the first scenario (i.e. the one at the top of the dataset list reported in the OUTPUT screen) and the Reference Scenario as far as the key indicators are concerned.

Depending on the spatial aggregation level of the analysis (European or country level), by clicking on the **Var. from Ref. Scenario** button, you will be taken respectively to the screen shown in Figure 5-6 or to the one shown in Figure 5-7.



Source: TRT

Figure 5-6: The differences with respect to reference scenario screen

At European aggregation level, differences are shown in two ways:

- a) For each key indicator, two line graphs are shown. The first graph shows the trend of the indicator in absolute terms over the simulation period in the policy scenario. The second graph shows the trend of the relative difference between the policy and the reference scenario over the simulation period.
- b) Two radar graphs are shown in the right side of the screen. These graphs allow you to see the value of the five key indicators in the policy scenario and in the reference scenario for the years 2030 and 2050.

In the upper side of the screen there three buttons to choose for which aggregation of EU countries you want to see the differences: for EU27, EU15 or EU12.

If you click the **Country** button, you will be redirected to another page, where the comparison is presented with the layout of the indicators main screen (see paragraph 5.3.1).

						ENF-UNIT	22011
r passenger transport activity by origin country and mode 1764, pass_Yearly_Crogo.pkm.per_Mode_per_Country_var	35	Time (Year) "TRA_pass_Yearly_Ori	1996 gin_pkm_per_Mode_per_0	1997 Country[Car,Coun	1998 try]* Runs:	1999 ASTRA_EC	2000 Sc_Referen
		[Car.AT]	n_pkm_per_Mode_per_C 62.462	63.234	64,370	65.678	67.077
ick freight transport activity by origin country and mode	3.0	[Car.BE]	96.626	98,142	99,630	101.086	102,747
TRA_tre_Yearly_Ongin_Rom_per_Mode_per_Country_var		[Car,DK]	46,323	46,943	47,531	47,964	48,353
		[Car,ES]	247,793	258,216	269,221	280,289	291,78
P	39	[Car,FI]	52,854	54,134	55,672	57,390	59,207
wee_bbi_one_val		[Car,FR]	638,958	651,692	663,234	676,334	691,70
	1 million (1997)	[Car,UK]	615,139	618,377	620,135	621,248	621,14
2 transport emissions (tank-to-wheel)	33	[Car,DE]	816,361	822,908	828,316	835,518	844,28
ENV_Yearly_CO2_emissions_var		[Car,EL]	56,492	58,635	60,595	62,762	64,771
		[Car,IE]	32,332	33,719	35,368	37,181	38,792
ployment		[Car,IT]	617,385	629,936	645,012	660,868	675,6
MAC_emp_Employment_var		[Car,NL]	124,386	126,854	129,498	131,840	133,9
		[Car,PT]	61,742	63,834	66,375	68,904	71,23
		[Car,SE]	87,945	89,028	90,058	91,247	92,62
		[Car,BG]	25,442	25,871	26,149	20,400	26,90
		[Car,CH]	74,309	75,527	76,260	77,239	78,52
		icar, cij	5,094	5,174	5,237	3,343	5,991
		[Car,CZ]	5675	5 744	54,004	5 027	6 067
		(Car HU)	45 737	46 320	46.951	47 202	48.00
		[Car, IV]	8 386	8 778	9 089	9 506	10.00
		[Carl T]	17.650	18 234	19 040	20.061	21 32
		[Car MT]	1.411	1.447	1.486	1.524	1.561
		[Car NO]	47.462	48.850	50.365	51.647	52.51
		[Car.PL]	135,599	143,002	151.250	160,661	170.6
		[Car.RO]	44,254	46.261	48.223	50.359	52.85
		[Car.SI]	17,802	18.413	19.035	19,561	20.13
		[Car.SK]	16,640	17,359	17,998	18,789	19,98
		Con LUI	4 3 7 7	1 520	1 60.9	4.971	\$ 0.55

Source: TRT

Figure 5-7: The differences with respect to reference scenario screen at country level

The **<< Back** button at the upper right side of the windows take you back to the OUTPUT screen.

5.3.2 Looking at indicators by group

Clicking on one button related to a group of results in the OUTPUT screen the relative INDICATORS screen is opened (see Figure 5-8). An INDICATORS screen is made of the same sections as the KEY INDICATORS screen (see Figure 5-3). Some differences are reported below:

ASSIST - ASsessing the Social and econ	omic Impacts of past and future	Sustainable Transport policy in Europe							
10	UTPUT / TRANSPOR	RT INDICATORS (2/3)							
755157 EU27	EU15 EU12	Country	NUTSI	Table Graph				EXPORT	PRINT
Passenger road vehicle-km in the Mio Vikmiyear - 7RA_pass_road_vikm_	e country by mode by_mode_per_Country		>>	Time (Year) "TRA_pass_Yearly_Origin_pkm TRA_pass_Yearly_Origin_pkm	1996 _per_Mode_per_ per_Mode_per_	1997 Country[PassMod	1998 e,Country]" Runs:	1999 Project_Scen	2000 ·
Freight road vehicle-km in the co Mio Vkm/year - TRA_fre_road_vkm_pe	untry by mode			[Car,AT] : ASTRA_EC_Sc_Reference [Car,BE]	62,365 62,365 96,624	63,035 63,035 97,958	64,143 64,143 99,279	65,280 65,280 100,533	66,277 66,277 102,050
Freight LDV vehicle-km in the co Mo View/year - TRA_fre_LDV_view_tra	untry by mode		35	: ASTRA_EC_Sc_Reference [Car,DK] : ASTRA_EC_Sc_Reference	96,624 46,101 46,101	97,958 46,484 46,484	99,279 46,782 46,782	100,533 46,925 46,925	102,050 47,064 47,064
Freight HDV vehicle-km in the cc Mio Vkm/year - TRA_fre_HDV_vkm_fra	untry by mode		>>	[Car,ES] : ASTRA_EC_Sc_Reference [Car,FI]	248,050 248,050 52,921 52,031	259,106 259,106 54,223	271,031 271,031 55,707	283,075 283,075 57,220	295,553 295,553 58,780
Passenger transport volumes by Mio Pass/year - TRA_pass_Trips_Org	origin country and mode nating_per_Mode_per_EC		>>	[Car,FR] : ASTRA_EC_Sc_Reference [Car,UK]	637,405 637,405 613,524	650,185 650,185 614,494	660,317 660,317 613,960	670,365 670,365 613,643	680,284 680,284 613,473
Passenger transport volumes by Mo Passiyear - TRA_pass_Yearly_Org	mode in urban context gin_Urban_hips_per_Mode_per_	Country	>>	: ASTRA_EC_Sc_Reference [Car,DE] : ASTRA_EC_Sc_Reference	613,524 816,847 816,847	614,494 823,652 823,652	613,960 829,566 829,566	613,643 835,501 835,501	613,473 840,857 840,857
Passenger transport volumes by Mo Pasalyear - TRA_pass_Yearly_On	mode in inter-urban conte pin_interUrban_tripa_per_Mode	xt per_Country	>>	[Car,EL] : ASTRA_EC_Sc_Reference [Car,IE]	55,952 55,952 32,324	57,534 57,534 33,645	58,970 58,970 35,179	60,572 60,572 36,843	61,998 61,998 38,354
Freight transport volumes by orig Mo Toniyear - TRA_fre_Yearly_Orga_	in country and mode Tons_per_Mode_per_Country		>>	: ASTRA_EC_Sc_Reference [Car,IT] : ASTRA_EC_Sc_Reference	32,324 614,663 614,663	33,645 624,269 624,269	35,179 636,637 636,637	36,843 649,503 649,503	38,354 661,129 661,129
Car ownership Vehicle / 1000 pers - VFT_car_Car_Ow	serahip		Map >>	[Car,NL] : ASTRA_EC_Sc_Reference [Car,PT]	124,397 124,397 61,230	126,898 126,898 62,950	129,547 129,547 65,100	131,767 131,767 67,162	133,782 133,782 69,093
PREVIOUS Transport	indicators	NEXT Transport indical	tors	: ASTRA_EC_Sc_Reference [Car,SE]	61,230 87,388	62,950 87,990	65,100 88,543	67,162 89,335	69,093 90,252
Loaded nine:	Select the zones and	modes		: ASTRA_EC_Se_Reference	87,388	87,990	88,543	89,335	90,252
Project Scenario	Country	Country Freight Mode Gross Veh. Weights		: ASTRA EC Sc Reference	25,582	26,269	26,972	27,779	28,807
ASTRA_EC_Sc_Reference	Gross Veh. Weights			[Car,CH]	74,489	75,527	76,502	77,555	78,567
1 YO YO KING TANKA YO KING A 250	Passenger Mode			: ANIKA_EC_Sc_Reference	74,489	75,527	76,502	77,355	78,567
	Other output indicato	rs		: ASTRA_EC_Sc_Reference	3,071	3,122	3,174	3,225	3,282
Change	KEY	ECO ENV	SOC	4 (million)					
		1		1.51 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1.					

Source: TRT

Figure 5-8: The TRANSPORT INDICATORS screen

- The group of buttons to change the level of spatial aggregation for the indicators shown can include:
 - o EURO (Eurozone)
 - o NUTS II
- Usually, in each group there are different indicators which cannot be shown on one page conveniently. Therefore, at the end of the list of indicators (section 3 of the layout) there are buttons to visualize another set of indicators of the same group.
- Some indicators have an additional **Map** button to the left of the >> button; by clicking on it a choropleth map for the selected variable will be shown (see chapter 5.3.2.1).
- The Var. from Ref. Scenario button (see frame 8 of the screen in Figure 5-3) is not available⁴.

The list of output indicators by group is provided in Annex 2, with a short description and details on their segmentation.

⁴ The variation from the reference scenario can be analysed by loading the corresponding dataset together with the policy scenario dataset.

5.3.2.1 Map: mapping the outcomes

As mentioned above, for some indicators a **Map** button is available in the INDICATORS screen. When you click on the **Map** button, a choropleth map related to the indicator is displayed (see Figure 5-9). This map shows the value of the indicator in each zone (country or NUTS II) at a specific moment in time (the map opens showing data at 1995, see below for the representation of the following years). The legend of the map to interpret colours is on the left side of the map canvas. Different intervals can be defined (see below for more details).



Source: TRT

Figure 5-9: Example of the map window for one indicator

The name of the selected indicator is shown on the upper side of the window. Below there is the name of the corresponding full subscripted variable in the model.

If more scenario datasets are activated, a different map is produced for each scenario. The maps for each scenario are accessible by means of tabs at the top of the map canvas (see Figure 5-10). To select the map for a given scenario just click on the related tab.

The third tab is named "**compare**" (it is displayed only when at least two scenarios are loaded). If you want to see the relative differences between two scenarios (the first two scenarios in the order shown in the list of load datasets, see above), select the "**compare**" tab and a map of differences will be displayed.



Source: TRT

Figure 5-10: Tabs in the map window

The relative differences (in percentages) shown in the map are computed as:

(Scenario2 / Scenario1 - 1) * 100

Where *Scenario2* is the scenario under the second tab ("ASTRA-EC-Sc_Reference" in Figure 5-10) and *Scenario1* is the scenario under the first tab ("Project scenario" in Figure 5-10).

If the variable has just one subscript besides the subscript "country" (or "nuts2"), the map represents the values corresponding to a given element of that subscript. For instance if the variable is segmented by country and transport mode, the map will be shown for one transport mode.

If the variable has more subscripts besides the zonal subscript, the map represents the values corresponding to a combination of one element for each subscript. For instance, if the variable is segmented by country, transport mode and income group, the map will be shown for one transport mode and one income group.

The ranges of the subscripts associated to the selected indicator are shown in one or more combo boxes. You can use this boxes <u>to select a different element for each subscript</u>. When you select different subscripts the map will be automatically updated.

On the lower side of the main window you can see the year the map refers to (see Figure 5-11). By default when the map is first displayed, it refers to the year 1995 (the initial year of the simulation period). You can <u>change the reference year of the map</u> in two

ways: either typing a new year in the cell or moving the slider. If you click on the **Play** button on the right side of the time line an animation of the map starts and you can observe how it changes year by year until the end of the simulation period.



Source: TRT

Figure 5-11: The control of time dimension in the map window

If you click on the **Select zone** button below the legend, a table listing the zone will be shown (see Figure 5-12Figure 5-16). By double-clicking on the row corresponding to a zone, that zone will be selected and a histogram graph is displayed above the time line. The histogram graph depicts the outcomes of the selected zone for the selected combination of subscripts elements over time for the whole simulation period (see Figure 5-13).

A zone can be selected by clicking on its shape as well.

By clicking on a bar of the histogram, the corresponding year will be selected and subsequently the map will be updated.



```
Source: TRT
```

Figure 5-12: The list of the zones



Figure 5-13: The histogram graph showing the indicator value for a selected country

You can change the theme of the map in two ways.

If you want just to change one or more colours used in the map, you can click on the coloured box on the left side of a range in the legend (Figure 5-14) and choose a different colour.



Figure 5-14: The legend in the map window

If you also want <u>to change the number of ranges and the limits of each range</u>, click on the **Change** link at the bottom of the legend. The theme dialog window shown in Figure 5-15 will be opened.

Through the theme dialog window you can change the number of ranges, the limits and the colour of each range. In order to ease the choice of the ranges, the window shows the minimum, the maximum and the mean value of the selected indicator (for the selected subscripts and scenarios) and a histogram of the outcomes.

<u>To change the number of ranges</u> you can select a different number from the control "Number of ranges" in the upper left side of the window.

<u>To change the boundary values of the ranges</u> you can type the new values in the cells "from" and "to". Clicking on the **suggest interval** button the system will automatically set some ranges. You can use these ranges or adjust them manually as preferred.

To change the colours associated to ranges you can click on the coloured box and choose a different colour.





In the upper right side of the map window three buttons (highlighted in Figure 5-16) aim to:

- toggle on/off the histogram graph, enabling or not its visualization
- toggle on/off the legend
- exporting all the indicator outcomes, related to the corresponding zone, and saving it as a shapefile.





5.4 Verify policy changes

When comparing the results of different scenarios, you might want to understand which different input has been used in each run in order to understand the cause of different results. The second button in the upper side of the OUTPUT screen, under the current localization and the links to the parent directories is the **Verify policy changes** buttons. You can use this button to check which difference exists between two scenarios.

By clicking on the **Verify policy changes** a new screen will be opened (see Figure 5-17). In this screen there is a button for each available policy measure (see Annex 4) in the left side and a report window in the right side. In the report window the values of the variables that a selected policy influences are shown for two scenarios and for the whole simulation period. Each variable is repeated twice in the report window to facilitate the comparison: the order of the rows reflects the order of the loaded scenarios, the first two datasets in the list shown in the lower left corner of the screen.

Since the amount of data can be large the comparison in the report window can be difficult. You can use the **Export** button to copy the content of the window in the clipboard and paste in a different application (e.g. in Excel) to have a closer look. If you want you can also use the **Print** button to print the content of the window.

PSSIST			University of the second secon			EVENET	- I post	
0312			Urban road user charging	1006	1002	LOOP	1000	
			Time (Tear)	1990	1997	1998	1999	
cing		Internal Markets	Switch_urban_pricing					
Urban road user charg	ing	Conditions for truck drivers	Switch_urban_pricing					
Car road charging sche	mes	No restrictions on cabotage	Switch urban prining input					
Railway infrastr changes - nass		Community railway liberalisation	Switch urban pricing input					
Rahury intrastr charges	freicht	Integration of inland waterware						
Halway intrastr. charges - treight		Die Dot						
EOKOVIGNETTE: Dire	cove	Blue Belt	Year_urban_pricing					
Internalisation of costs -	pass	Single European Sky I	TRA pass urban road charge policy[BE1]	0	0	0	0	
Internalisation of costs -	treight	Efficiency standards	TRA pass urban road charge policy[BE2]	õ	0	õ	õ	
0.4400		Enciency sumourds	TRA pass urban road charge policy[BE3]	0	0	0	0	
xation		CO2 emission limits	TRA pass urban road charge policy[BG3]	0	0	0	0	
Energy Taxation Direct	live	Standards for air pollution	TRA pass_urban_road_charge_policy[BG4]	0	0	0	0	
Linkinin toroton			TRA_pass_urban_road_charge_policy[CZ0]	0	0	0	0	
venicae taxasion		Transport Planning	TRA_pass_urban_road_charge_policy[DK0]	0	0	0	0	
CO2 certificate			TRA_pass_urban_road_charge_policy[DE1]	0	0	0	0	
Feebates		Energy efficiency commercial veh.	TRA_pass_urban_road_charge_policy[DE2]	0	0	0	0	
		City logistic	TRA_pass_urban_road_charge_policy[DE3]	0	0	0	0	
frastructure Research and Innov.		Sector contraction and the	TRA_pass_urban_road_charge_policy[DE4]	0	0	0	0	
		Research and Innovation	TPA mass urban road charge policy[DE5]	0	0	0	0	
TEN-T projects acceler	ateu	Electromobility Board	TRA pass urban road charge policy[DE6]	0	0	0	0	
Improving local PT service	ices	Lies of modely Podel	TRA pass_urban_road_charge_policy[DE/]	0	0	0	0	
		HZ Fuel Cell vehicles	TPA pass urban road charge_policy[DE0]	0	0	0	0	
		Compulsory safety standards	TRA pass_urban_road_charge_policy[DE4]	0	0	0	0	
		Replacement rate of inefficient vehicles	TRA pass urban road charge policy[DER]	ő	0	0	0	
		The second second second second	TRA pass urban road charge policy[DEC]	0	0	0	0	
	1		TRA pass urban road charge policy[DED]	0	0	0	0	
Loaded runs: Compariso		of inputs	TRA pass urban road charge policy[DEE]	0	0	0	0	
Designat Sciencesia	of the first tw	o scenarios loaded.	TRA pass urban road charge policy[DEF]	0	0	0	0	
ASTRA EC. Sr. Belevence			TRA pass urban road charge policy[DEG]	0	0	0	0	
warran and and and and and a	Each variable is	repeated twice in the table	TRA pass urban road charge policy[EE0]	0	0	0	0	
	to facilitate the c	omparison	TRA pass urban road charge policy[IE0]	0	0	0	0	
	the order of the r	ows reflects the order of the	TRA pass urban road charge policy[GR1]	0	0	0	0	

Source: TRT

Figure 5-17: The screen to compare the inputs for two scenarios

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Annex 1

Description of the output indicators

The following table reports the list of output indicators available in the ASTRA-EC interface, with a short description and details on segmentation.

Indicator	Description	Segmentation	Unit
TRANSPORT			
Passenger transport activ- ity by origin country and mode	Passenger transport demand generated by each country in terms of passenger-km by mode	Country (or NUTS II), mode (car, bus, train, air, slow)	Mio Pkm/year
Freight transport activity by origin country and mode	Freight transport demand gen- erated by each country in terms of tonnes-km by mode	Country, mode (truck, train, IWW, maritime)	Mio Tkm/year
Passenger modal split (on pkm)	Percentage share of each mode of transport in total passenger demand generated by country in terms of passenger-km	Country (or NUTS II), mode (car, bus, train, air, slow)	%
Freight modal split (on tkm)	Percentage share of each mode of transport in total freight de- mand generated by country in terms of tonnes –km	Country, mode (truck, train, IWW, maritime)	%
Passenger transport activ- ity by mode in urban / inter-urban context	Passenger transport demand generated by country in urban / inter-urban context ('Urban-rural typology' definition of EUROSTAT) in terms of pas- senger-km by mode	Country (or NUTS II), mode (car, bus, train, air, slow)	Mio Pkm/year
Passenger modal split (on pkm) in urban / inter- urban context	Percentage share of each mode of transport in total passenger demand generated by country in urban / inter-urban context ('Urban-rural typology' definition of EUROSTAT) in terms of pas- senger-km	Country (or NUTS II), mode (car, bus, train, air, slow)	%
Freight transport activity by mode and distance band	Freight transport demand gen- erated by country in different distance band in terms of tonnes-km by mode	Country, mode (truck, train, IWW, maritime), dis- tance band (<300 km, 300-1000 km, >1000 km)	Mio Tkm/year
Passenger transport activ- ity by mode and distance band	Passenger transport demand generated by country in differ- ent distance band in terms of passenger -km by mode	Country, mode (car, bus, train, air), distance band (<300 km, 300-1000 km, >1000 km)	Mio Pkm/year
Passenger road vehicle- km in the country by mode	Traffic volume in terms of vehi- cle-km of passenger cars and bus travelling on the road net- work of the national territory of each country	Country, mode (car and bus)	Mio Vkm/year

|--|

Indicator	Description	Segmentation	Unit
Freight road vehicle-km in the country by mode	Traffic volume in terms of vehi- cle-km of trucks (HDV and LDV) travelling on the road network of the national territory of each country	Country	Mio Vkm/year
Freight LDV vehicle-km in the country by mode	Traffic volume in terms of vehi- cle-km of LDVs travelling on the road network of the national territory of each country	Country	Mio Vkm/year
Freight HDV vehicle-km in the country by mode	Traffic volume in terms of vehi- cle-km of HDVs travelling on the road network of the national territory of each country	Country	Mio Vkm/year
Passenger transport vol- umes by origin country and mode	Passenger transport demand generated by country in terms of trips by mode	Country (or NUTS II), mode (car, bus, train, air, slow)	Mio Pass/ year
Passenger transport vol- umes by mode in urban / interurban context	Passenger transport demand generated by country in urban / inter-urban context ('Urban-rural typology' definition of EUROSTAT) in terms of trips by mode	Country (or NUTS II), mode (car, bus, train, air, slow)	Mio Pass/ year
Freight transport volumes by origin country and mode	Freight transport demand gen- erated by country in terms of tonnes by mode	Country, mode (truck, train, IWW, maritime)	Mio Ton/year
Car ownership	Motorisation rate in terms of ratio between cars and inhabitants	Country	Vehicle / 1,000 in- habitants
Car fleet composition by fuel type	Number of cars in each country by fuel type	Country, fuel type (gasoline, diesel, CNG, LPG, hy- brid, electric, bio- fuel, hydrogen)	Vehicles
Bus fleet	Number of buses in each coun- try	Country	Vehicles
Light duty vehicles com- position	Number of LDVs in each coun- try by fuel type	Country, fuel type (gasoline, diesel, electric)	Vehicles
Heavy duty vehicles	Number of HDVs in each coun- try by vehicle size	Country, vehicle size (<12 t, >12 t)	Vehicles
ENVIRONMENT			
CO2 transport emissions (tank-to-wheel)	Transport CO2 emissions (hot and cold start) by country	Country	tons/year
CO2 transport emissions per capita (tank-to-wheel)	Transport CO2 emissions per inhabitant (hot and cold start) by	Country	tons/pers

Indicator	Description	Segmentation	Unit
	country		
CO2 transport emissions by mode (tank-to-wheel)	Transport CO2 emissions (hot and cold start) by mode and by country	Country, mode (road passenger, road freight, rail- ways, maritime, airplane, IWW)	tons/year
CO2 transport emissions (well-to-wheel)	Transport CO2 emissions (hot, cold start, fuel production and vehicle production) by country	Country	Thousand tons/year
Average tank-to-wheel CO2 emissions of car fleet	Average CO2 emissions per km of cars travelling in each country	Country	g/Vkm
Transport emissions by pollutant (tank-to-wheel)	Transport polluting emissions (hot and cold start) by pollutant and by country	Country, pollutant (NOx, VOC, CO, PM2.5)	tons/year
Transport emissions per capita by pollutant (tank- to-wheel)	Transport polluting emissions (hot and cold start) per inhabit- ant by pollutant and by country	Country, pollutant (NOx, VOC, CO, PM2.5)	tons/pers
Transport emissions by pollutant by mode (tank-to-wheel)	Transport polluting emissions (hot and cold start) by mode, by pollutant and by country	Country, pollutant (NOx, VOC, CO, PM2.5), mode (road passenger, road freight, rail- ways, maritime, airplane, IWW)	tons/year
Total transport fuel con- sumption	Total transport fuel consumption by country	Country	Mtoe
Total transport fuel con- sumption per capita	Total transport fuel consumption per inhabitant by country	Country	Mtoe/pers
Transport fuel consump- tion by mode and fuel type	Transport fuel consumption by mode, by fuel type and by coun- try	Country, mode (road passenger, road freight, rail- ways, maritime, airplane, IWW), fuel type (Diesel, Gasoline, Biofuel, Electricity)	Mtoe
Total transport fuel con- sumption by fuel type	Transport fuel consumption by fuel type and by country	Country, fuel type (Diesel, Gasoline, Kerosene, Biofu- el, CNG, LPG, Electricity, Hydro- gen)	Mtoe
Total transport fuel con- sumption per capita by fuel type	Transport fuel consumption per inhabitant by fuel type and by country	Country, fuel type (Diesel, Gasoline, Kerosene, Biofu- el, CNG, LPG, Electricity, Hydro-	Mtoe/pers

Indicator	Description	Segmentation	Unit
		gen)	
ECONOMY			
Economic value of CO2 emissions	Total external cost of transport CO2 emissions (well to wheel) by country	Country	Mio. Euro/ year
Economic value of pollu- tant emissions	Total external cost of transport pollutant emissions (Nox, VOC, PM and SO2, tank to wheel) by country	Country	Mio. Euro/ year
Economic value of CO2 emissions per capita	External cost of transport CO2 emissions (well to wheel) per inhabitant by country	Country	Euro/pers
Economic value of pollu- tant emissions per capita	External cost of transport pollu- tant emissions (Nox, VOC, PM and SO2, tank to wheel) per inhabitant by country	Country	Euro/pers
Total Factor Productivity		Country	n.a.
GDP	Gross domestic product by country	Country	Mio. Euro/ year
GDP per capita	Gross domestic product per inhabitant by country	Country	Euro/Pers
Consumption	Total value of consumed goods and services without taxes by country	Country	Mio. Euro/ year
Investments	Total value of investments with- out taxes by country	Country	Mio. Eu- ro/year
Exports	Total value of goods and ser- vices exported by country(in Europe and in the rest of the World)	Country	Mio. Euro/ year
Fuel taxation revenues	Revenues from fuel excises levied on transport fuel con- sumption by country	Country	Mio. Euro/ year
Fuel taxation revenues per capita	Revenues from fuel excises levied on transport fuel con- sumption per inhabitant by country	Country	Mio. Euro/ year/Pers
Road charging revenues (Total)	Total revenues from road charg- ing of passenger and freight vehicles by country	Country	Mio. Euro/ year
Road charging revenues (Passenger)	Revenues from road charging of passenger vehicles by country	Country	Mio. Euro/ year
Road charging revenues (Freight)	Revenues from road charging of freight vehicles by country	Country	Mio. Euro/ year

Indicator	Description	Segmentation	Unit
Road charging revenues per capita	Total revenues from road charg- ing of passenger and freight vehicles per inhabitant by coun- try	Country	Mio. Euro/ year/Pers
Households transport expenditure / GDP	Ratio between total households transport expenditure and Gross Domestic Product	Country	%
Average transport ex- penditure per trip at local level per country by mode	Average expenditure of local trips (within NUTS II zones) by mode and by country ¹	Country, mode (car, bus, train)	euro/trip
Average transport ex- penditure per trip at inter- urban level per country by mode	Average expenditure of inter- urban trips (between NUTS II zones) by mode and by coun- try ¹	Country, mode (car, bus, train, air)	euro/trip
Average transport time per trip at local level per country by mode	Average duration of local trips (within NUTS II zones) by mode and by country	Country, mode (car, bus, train)	h/trip
Average transport time per trip at inter-urban level per country by mode	Average duration of inter-urban trips (between NUTS II zones) by mode and by country	Country, mode (car, bus, train, air)	h/trip
SOCIETY			
Population distribution per income group	Share of inhabitants whose indi- vidual income falls within a given income group by country	Country, income group (low, low to medium, medium, medium to high, high income)	%
Share expenditures for mobility on total consump- tion per income group	Ratio between total household expenditure for mobility and total consumption by income group and by country	Country, income group (low, low to medium, medium, medium to high, high income)	%
Employment	Number of Employed inhabitant (part of the active labour force) by country	Country	Thousand Persons
Mode split passenger per mode and income group	Percentage share of each mode of transport in total passenger demand generated by each income group in terms of pas- senger-km by origin country	Country, mode (car, bus, train, air, slow), income group (low, medi- um, high income)	%
Average mobility expendi- ture per income group	Average expenditure for mobili- ty per inhabitant by income group and by country	Country, income group (low, medi-	Euro/pers year

¹ The indicator is an average estimated from the output of the model, in terms of ratio between total expenditure and total demand. Therefore, it is influenced by the distribution among distance band and the related cost, not only by the trend of pure cost by mode

Indicator	Description	Segmentation	Unit
		um, high income)	
Average distances per income group	Average distance travelled per trip by income group by country	Country, income group (low, medi- um, high income)	km/ year
Potential national acces- sibility* by mode	Indicator of potential accessibil- ity to local and national destina- tions by mode. Ratio between the value for a NUTS II zone and the average national value	NUTS II zone, mode (car, bus, train, air)	Dmnl
Potential national acces- sibility*	Indicator of potential accessibil- ity to local and national destina- tions by income group. Ratio between the value for a NUTS II zone and the average national value	NUTS II zone, income group (low, medium, high income)	Dmnl
Potential international accessibility* by mode	Indicator of potential accessibil- ity to international destinations by mode. Ratio between the value for a country and the av- erage European value	Country, mode (car, bus, train, air)	Dmnl
Potential international accessibility*	Indicator of potential accessibil- ity to international destinations by income group. Ratio be- tween the value for a country and the average European val- ue	Country, income group (low, medi- um, high income)	Dmnl
Accidents (fatalities, inju- ries) by mode	Number of individuals involved in accidents by accident seri- ousness, by mode and by coun- try	Country, mode (road passenger, road freight, rail- ways, maritime, airplane, IWW), type of accident (fatalities, serious and light injuries)	Pers
Accidents (fatalities, inju- ries) by mode per capita	Ratio between the number of individuals involved in accidents and total population by accident seriousness, by mode by country.	Country, mode (road passenger, road freight, rail- ways, maritime, airplane, IWW), type of accident (fatalities, serious and light injuries)	pers/Mio. inhab.

* see Deliverable D4.2 (chapter 6) for more information on the accessibility indicator Source: TRT / Fraunhofer-ISI

Annex 2

Description of the main conventions used in the equations of the model's variables and error messages

This section describes the most relevant conventions used in Vensim and possible error messages, for more details the user is referred to Vensim tutorial and user manual. They are available via the Vensim software.

Conventions

Variable[subscript]

Subscripts are enclosed in square brackets [] directly following the variable name.

SUM

sum the elements of a variable over the subscript range(s) with exclamation ! mark(s).

Example:

SUM(trips[mode, country!])

Means: sum of the values over all countries (whereas mode remains separated)

ZIDZ (A, B)

divide A by B. If B is zero (actually smaller than 1E-6), the function returns 0

DELAY FIXED (input, delay time, initial value)

returns the value of a variable (input) delayed by a specific time step (delay time). At the first year of simulation, the initial value is used.

INTEG (rate, initial value)

represents stock variables, returning the integral of the rate. At the first year of simulation, the initial value is used.

WITH LOOKUP(x,(L#))

represents a relationship between an input variable x and an output variable.

The lookup equation is not immediately understandable but it merely correspond to a series of x,y pairs specified as numbers. These pairs can be seen by selecting the variable, asking for the equation and then clicking on "as graph" in the dialog window.

Error messages

Not enough memory - decrease lenght or increase SAVEPER

The error might be related to a Vensim bug: close the interface and the Vensim software and re-open it.

Insufficient memory to allocate handle for X bytes

The error is related to a Vensim bug: close the interface and the Vensim software and re-open it. In case the error message persists, the cause could be an insufficient computing power of the machine where ASTRA-EC is installed.

Floating point error computing Variable[subscript] at time X

The error might be related to the input implemented by the user, especially in case very small or very high values are set. Please check your inputs and re-run the model.

Annex 3

Content and meaning in modelling terms of all policy measures

1.1.1 Pricing

1.1.1.1 Urban road user charging / access restrictions

Policy set to charge car vehicles for entering in urban areas (charge is in Euro / trip).

Two options are available to the user: the charge can be differentiated by NUTS I zone or the same charge can be applied in each country.

- The charge is applied to private cars only; buses and freight vehicles are not charged.
- This measure is implemented taking into account that urban pricing would be adopted only in larger cities, only in a portion of the city and only for some time of the day. Therefore, in each intra NUTS II distance band (local, very short and short) the car costs are increased by a fraction of the charge assumed by the user in real terms and not by the whole charge. For instance, in general it is assumed that 5% of the trips undergo the charge (taking into account the portion of the city and the time of the day), so if the user sets a charge of 5 Euro/trip, the value of the charge applied in the model (namely the additional car costs) will be 5 * 0.05 = 0.25 Euro. This additional cost is applied to all car trips travelling at any time of the day in urban context in a specific zone and distance band (the share of urban area is estimated on the basis of the classification by 'Urban-rural typology' of EUROSTAT).
- When a flat value is chosen the charge is applied in the year selected as starting time for the measure and remains applied for the rest of the simulation.
- With a detailed implementation (by NUTS I zone), the user can modulate the value of the charge over the application period, starting from the year selected as

starting time for the measure². In case the policy shouldn't be applied in some zones, the user must set a null value in the corresponding cell of the exogenous file.

- In order to provide a reference to the user, a predefined value for the policy is set to 3 euro/trip in the interface. This value is based on the range of charge of existing examples of urban road charging (i.e. London, Stockholm, Milan).

1.1.1.2 Car road charging schemes

Policy set to charge cars for the use of the motorway road network (charge in Euro / vkm).

The user can define the charge in two ways: a simple one (defining a charge to be added in the same way in all countries) and a detailed one (defining a charge by country and vehicle type).

- The charge is applied to private cars; the charge for buses is estimated by doubling the charge for private cars.
- The charge is applied to cars, the increment of travel cost per passenger-km (i.e. the one used for mode split) depends on the average occupancy factor.
- When a detailed implementation is chosen and charge is differentiated by vehicle type, the model computes endogenously the average national value of the charge using the fleet composition from the fleet module.
- This measure is implemented taking into account that the motorway network is used only for a part of some trips, depending also on the total distance travelled (i.e. the distance band). The share of the road traffic flow travelling on the motorway network by distance band is also part of the policy input with detailed approach, in case it is assumed to be an extension of the tolled network. Therefore, the car costs for travelling through a specific zone are increased by a fraction of the charge selected by the user, depending on this assumption. For instance, in a

² With a detailed implementation, the values defined by the user in the exogenous file have to be consistent in terms of initial year with the year selected as starting time in the interface. In case there is an discrepancy, the year selected as starting time in the interface is used as reference to start the implementation of the measure.

zone where at national level the motorway is assumed to be used by 15% of the car trips (taking into account the extension of the network), if the user sets a charge of 0.07 Euro/vkm, the value of the charge applied in the model will be 0.07 * 0.15 = 0.0105 Euro/vkm. This charge is applied to all car trips travelling through that specific zone at national level.

- When a flat value is chosen the charge is applied in the year selected as starting time for the measure and remains applied for the rest of the simulation.
- With a detailed implementation (by country and vehicle type), the user can modulate the value of the charge over the application period, starting from the year selected as starting time for the measure.
- The predefined values set in the interface are those of the Reference scenario. In case the policy shouldn't be applied in some zones, the user must keep the values of the exogenous file unchanged (i.e. equal to the Reference scenario).

1.1.1.3 Railway infrastructure charges directive (2001/14/EC)

Policy set to charge trains for the use of the rail infrastructure (charge in Euro / trainkm)

The user can define the charge in two ways: a simple one (with the same charge for all countries) and a detailed one (differentiated by country).

- It is assumed that the charge is paid by rail operators to run train services on the infrastructure.
- The impact of the charge on user cost (i.e. the one relevant for mode choice) is indirect because it is assumed that only a fraction of infrastructure costs are transferred to user tariffs.
- When a flat value is chosen the charge is applied in the year selected as starting time for the measure and remains applied for the rest of the simulation.
- With a detailed implementation (by country), the user can modulate the value of the charge over the application period, starting from the year selected as starting

time for the measure. In case the policy shouldn't be applied in some countries, the user must set a null value in the corresponding cell of the exogenous file.

 In order to provide a reference to the user, predefined values are set in the interface: 3 euro / train-km for passengers and from 3 to 8 euro / train-km for freight (respectively in EU15 and EU12 countries). This values are based on the range reported by Nash (2005)³.

1.1.1.4 EUROVIGNETTE' Directive / road charging heavy-duty vehicles

Policy set to charge truck vehicles for the use of the motorway road network (charge in Euro / vkm)

The user can define the charge in two ways: a simple one (defining the charge for LDV and HDV to be added in the same way in all countries) and a detailed one (defining a charge by country and vehicle type).

- The charge is applied to vehicles, the increment of travel costs per tonne-km (i.e. the one used for mode split) depends on the average load factor (which is different by vehicle size and country).
- When a detailed implementation is chosen and the charge is differentiated by vehicle type, the model computes endogenously the average national value of the charge using the fleet composition from the fleet module.
- This measure is implemented taking into account that the motorway network is used only for a part of some trips, depending also on the total distance travelled (i.e. the distance band). The share of the road traffic flow travelling on the motorway network by distance band is also part of the policy input with detailed approach, in case it is assumed an extension of the tolled network. Therefore, the truck cost for travelling through a specific zone is increased by a fraction of the charge selected by the user, depending on this assumption. For instance, in a zone where at national level the motorway is assumed to be used by 15% of the HDV trips (taking into account the extension of the network), if the user sets a charge of 0.13 Euro/vkm, the value of the charge applied in the model will be

³ Nash, C:A. (2005), Rail infrastructure charges in Europe. Journal of Transport Economics and Policy, 39(3), pp. 259-278.

0.13 * 0.15 = 0.020 Euro/vkm. This charge is applied to all HDV trips travelling through that specific zone at national level.

- When a flat value is chosen the charge is applied in the year selected as starting time for the measure and remains applied for the rest of the simulation.
- With a detailed implementation (by country and vehicle type), the user can modulate the value of the charge over the application period, starting from the year selected as starting time for the measure.
- The predefined values set in the interface are those of the Reference scenario. In case the policy shouldn't be applied in some zones, the user must keep the values of the exogenous file unchanged (i.e. equal to the Reference scenario).

1.1.1.5 Internalisation of external costs for specific modes of transport (road, rail, inland navigation, ports, airports)

Policy set to apply a charge on specific modes to internalise external costs (charge in Euro / vkm).

The user can implement the policy for each mode separately, for a selected group or all modes at the same time.

- There is a difference between this policy and the Eurovignette policy. Under the latter policy a charge is applied to the motorway network only. Instead, it is assumed that the internalisation of external costs occurs on the whole road network. Therefore, the internalisation of external costs is a stronger policy: for instance a given charge increases the truck costs more than the Eurovignette policy would do.
- There is a difference between this policy and the railway infrastructure charges policy. Under the latter policy a charge is applied to rail operators and only a fraction of the costs is transferred to user tariffs. Instead, it is assumed that the internalisation of external costs is fully paid by train users (i.e. customers and not operators). Therefore, the internalisation of external costs is a stronger policy: for a given charge it increases rail user costs more than the railway infrastructure charges directive policy.

- Air charge is applied to aircrafts, the increment of travel cost per passenger-km (i.e. the one used for mode split) depends on the average occupancy factor.
- Maritime charge is applied to ships, the increment of travel cost per tonne-km (i.e. the one used for mode split) depends on the average load factor.
- When a flat value is chosen the charge is applied in the year selected as starting time for the measure and remains applied for the rest of the simulation.
- With a detailed implementation (basically by country and mode), the user can
 modulate the value of the external costs over the application period, starting from
 the year selected as starting time for the measure. In case the policy shouldn't be
 applied in some countries or mode, the user must set a null value in the corresponding cell of the exogenous file.
- In order to provide a reference to the user, predefined values are set in the interface based on the internal costs reported by CE Delft, (2011)⁴.

1.1.2 Taxation

1.1.2.1 Energy Taxation

Policy set to simulate the framework for the taxation of energy products and electricity.

The user can implement the measure by setting the minimum tax rate in Euro per unit of fuel for all fuel types. The minimum tax rate will be set, starting at a point of time defined by the user and keeps constant until the final year of simulation.

- The minimum tax rates can be set for all energy and fuel types covered in ASTRA-EC. These are: petrol (gasoline), diesel, CNG (compressed natural gas), LPG (liquefied petroleum gas), kerosene, electricity, bioethanol and hydrogen.
- The unit for the minimum tax rate is in € per litre for all energy types instead of CNG, hydrogen and electricity. For CNG and electricity the unit is in € per kg and for electricity it is in € per kWh.

⁴ CE Delft, (2011) : External Costs of Transport in Europe, Update Study for 2008

- The minimum tax rate is applied in the year selected as starting time for the measure and remains applied for the rest of the simulation.

1.1.2.2 Vehicle taxation (circulation & registration taxes)

Policy set to simulate the implementation of common rules for annual car circulation taxes based on CO_2 emissions and the phase out of registration taxes at EU level in order to encourage the use of fuel efficient cars.

The user can activate the measure by choosing a year in which the policy shall be implemented. He can determine a development of a threshold in terms of direct (tank-to-wheel) CO_2 emissions measured by NEDC (New European Driving Cycle) under which no annual car circulation tax needs to be paid by the users. The development can be set for each year until 2050. For all cars emitting more CO_2 per vehicle-km than this threshold, the user can define a tax rate in constant Euro 2005 per additional gram of CO_2 per vehicle-km.

Relevant information on the content of the measure and its implementation:

- The measure covers only taxes for passenger cars and *not* for commercial vehicles.
- The tax rate can be set over the whole time period from the first year of implementation.
- The CO₂ based tax rate is then valid for all EU27 member states and cannot be distinguished by country.

1.1.2.3 CO₂ certificate

Policy set to simulate the implementation of a CO₂ certificate system.

The user can implement a certificate price in constant Euro's (2005) per ton CO_2 and define the trend for this price over the future time period.

Relevant information on the content of the measure and its implementation:

- The certificate price is converted in an additional cost by fuel type (depending on their CO₂ specific emission factor), which is applied to all users.

- The starting year of application depends on the trend of the CO₂ certificate price implemented by the user.

1.1.2.4 Feebates

Policy set to simulate the implementation of a feebates to stimulate the diffusion of low emission, fuel efficient and alternative fuel vehicles. A system offering rebates for purchasers of clean vehicles and in parallel setting fees for vehicles emitting more CO2 than a certain threshold is called feebates.

The user can define the feebates in the following two ways:

- The value of the fees (extra-costs) per gram CO₂, above a defined threshold can be implemented up to a plausible range for all EU member states in the same way.
- The threshold in terms of direct CO₂ emissions in gram per vehicle-km can be defined via a lookup function. This way, the user can implement changes of this threshold over time until 2050.
- If the average direct CO₂ emissions for a new registered car are below the threshold, then the car prices are reduced by a rebate in the same way.

Relevant information on the content of the measure and its implementation:

- The measure only covers passenger cars. Commercial vehicles are excluded from this measure.

1.1.3 Infrastructure (Transport & Information/Communication)

1.1.3.1 TEN-T projects accelerated implementation

Policy set to simulate an accelerated implementation of TEN-T projects, under the assumptions that the Core TEN Network will be completed by the year 2025 and the Comprehensive TEN Network by the year 2040.

Relevant information on the content of the measure and its implementation:

- The activation of this measure corresponds to apply a predefined reduction of travel time on all O/D pairs connected by routes passing through zones where

new links are built plus investments in transport infrastructures. The size of the reduction depends on the specific O/D pair; e.g. on average the travel time is diminished by 1% to 3% for rail mode in Germany.

- The implementation of TEN-T projects is assumed also in the reference scenario but with a longer timing. This measure does NOT imply larger time reductions or more investments than in the reference scenario. Its effect is to anticipate the reductions of travel time and the investments.
- The reduction of travel time and the amount of investment change during the simulation as the completion of the links occurs at different dates. After the year 2040 all projects are completed and neither further reductions of travel time nor further investments are implemented.

1.1.3.2 Improving frequency and reliability of service

Policy set to simulate an improvement of frequency and reliability of public transport services (bus or train), in terms of reduction of travel time at local level.

The user can implement the policy for each mode separately or for both bus and train at the same time.

- The activation of this measure corresponds to apply a reduction of travel time of bus and train (depending on the country and the initial level of service) in the intra-NUTS II distance bands. In addition, investments in transport infrastructure are implemented.
- The user can set the expected value of the average reduction of travel time for bus and train separately. Then, this value is differentiated by country through a dedicated parameter which takes into account the current level of bus and train service (i.e. where there is more or less room for improvements).
- The reduction of travel time set by the user occurs over a ramp up period of 3 years starting from the year selected for the application of the measure (to take into account the infrastructural and operational activities required for the improvement) and remains stable (in terms of percentage) for the rest of the simulation.

- In order to provide a reference to the user, predefined values are set in the interface. Based on professional judgment of local applications aiming at improving PT services (e.g. via bus priority lane, ITS infrastructure for information services, etc.), the predefined values imply a reduction of 3% to 8% of travel time of bus and of 8% to 20% of travel time of train (depending on the country and the initial level of service).
- The improvements assumed imply additional investments in transport infrastructure, so if this policy is activated the size of transport investments is larger than in the reference scenario.
- The additional investments start before the effects on travel time take place, i.e. at the year selected as starting time, and last during the 3 years of the ramp up period.

1.1.4 Internal Markets

1.1.4.1 EU-wide common job quality and working conditions for truck drivers SEC(2008)2632

Policy set to simulate the regulation of job quality and working conditions for truck drivers, assuming an impact on travel costs and travel time for the truck mode.

- The activation of this measure corresponds to apply an increment of truck long distance travel time and of truck driver labour cost.
- The user can set the expected value of the variation of time and the average impact on labour cost. Then, the value related to the truck driver costs is differentiated by country through a dedicated parameter. The differentiation reflects that enforcing driving rules can result in different extra-costs, depending on the initial conditions in the haulage sector (e.g. countries with many individual hauliers can be affected more than countries where larger firms operators are).
- The changes set by the user occur over a ramp up period of 2 years starting from the year selected for the application of the measure (to take into account the time needed for the implementation and the enforcement) and remain stable (in terms of percentage) for the rest of the simulation.

- In order to provide a reference to the user, predefined values are set in the interface. Based on professional judgment, the activation of this measure corresponds to apply an average increment of 15% of truck long distance travel time and a predefined increment of about 3% (on average) of the truck driver labour costs.
- The driver costs is only one component of the truck costs used for mode split (including fuel, maintenance, investments, etc.): increasing the driver costs by 3% means increasing total truck cost nearly by 1%.

1.1.4.2 Elimination of restrictions on cabotage

Policy set to simulate the elimination of restrictions on cabotage, assuming an impact on travel cost and the share of empty trips for the truck mode.

- The activation of this measure corresponds to apply a reduction of the truck driver costs and of the share of empty trips for the trucks. Both impacts are endogenously differentiated by country, depending on the diffusion of cabotage.
- The user can set the expected value of the average impact on the labour costs and the empty trips. Then, these values are differentiated by country through a dedicated parameter, depending on the diffusion of cabotage (in the countries where cabotage is already common, the impact of the policy is lower).
- The changes set by the user occur over a ramp up period of 2 years starting from the year selected for the application of the measure (to take into account the time needed for the implementation and the market adaptation) and remain stable (in terms of percentage) for the rest of the simulation.
- In order to provide a reference to the user, predefined values are set in the interface. Based on professional judgment, a reduction of about 5% to 10% (depending on the country) of the truck driver costs is set, together with a reduction of about 4% to 10% of the share of empty trips for trucks.
- The driver costs is only one component of the truck costs used in the mode split:
 e.g. reducing the former by 5% means reducing the total truck costs by nearly 2%.

1.1.4.3 Opening of the domestic rail passenger market; Community railway liberalisation SEC(2004)236, COM(2004)139

Policy set to simulate the EU open competition between rail passenger operators and the availability of an integrated Europe-wide railway network, assuming an impact on travel time and costs of passenger transport.

Relevant information on the content of the measure and its implementation:

- The activation of this measure applies a reduction of rail passenger user costs and of rail travel time for long distance trips (i.e. local rail is NOT affected by this measure).
- The user can set the expected value of the average impact on tariffs and travel time: the same variation (in relative terms) is applied for all countries. The changes set by user occur over a ramp up period of 5 years starting from the year selected for the application of the measure (to take into account the time needed for new operators to enter in the market) and remain stable (in terms of percentage) for the rest of the simulation.
- In order to provide a reference to the user, predefined values are set in the interface. Based on professional judgment, a 6% reduction of rail passenger user cost and a 3% reduction of rail travel time for long distance trips are implemented.

1.1.4.4 Stimulate the integration of inland waterways into the transport system (RIS integrated with eFreight and eCustoms)

Policy set to simulate the development of the River Information Services, assuming an impact on IWW transport time thanks to the reduction of administration burdens and the provision of information exchange for freight transport.

- The activation of this measure corresponds to apply a reduction of transport time by inland navigation for international trips (i.e. national inland navigation by rail is NOT affected by this measure).
- The variation is set by the user: the same variation (in relative terms) is applied for all countries.

- The time reduction occurs over a ramp up period of 2 years starting from the year selected for the application of the measure and remain stable (in terms of percentage) for the rest of the simulation.
- In order to provide a reference to the user, a 10% reduction of transport time by inland navigation for international trips is set in the interface. This is based on professional judgment.

1.1.4.5 Simplification of formalities for ships travelling between EU ports ("Blue Belt")

Policy set to simulate the simplification of administrative procedures for sea transport (cargo and passengers) between European ports, leading to shorter transport time and slightly reduced cost for ship freight mode.

- The activation of this measure corresponds to the application of a reduction of time in ports by maritime mode and of non-fuel ship costs.
- The user can set the expected value of the average impact on costs and time: the same variation (in relative terms) is applied for all countries.
- Short distance maritime transport will benefit most from the reduction of time in the port, because that portion of time has a higher weight on the overall journey time. The non-fuel ship costs are the main component of ship costs used for mode split: nevertheless, reducing these by 2% means reducing the total ship costs by 1.8%.
- The changes set by the user occur over a ramp up period of 3 years starting from the year selected for the application of the measure and remain stable (in terms of percentage) for the rest of the simulation.
- In order to provide a reference to the user, predefined values are set in the interface. Based on professional judgment, a 10% reduction of time in port for trips by maritime mode and about a 2% reduction of non-fuel ship costs are implemented.

1.1.4.6 Single European Sky II (COM(2008)389)

Policy set to simulate the Single European Sky initiative (SESAR) with the improvement of flight path efficiencies, assuming a decrease of passenger costs and time at the airport, as well as an increased fuel efficiency.

- The activation of this measure corresponds to apply a reduction of time at the airport, differentiated by NUTS I zone depending on the current level of delays of each airport of the zone.
- In addition, thanks to reduced cost for the airlines, also the non-fuel component of passenger costs is assumed to be decreased. Finally, fuel efficiency during airplane take-off and landing is assumed to be improved.
- The user can set the expected value of the average impact on time, costs and efficiency: the same variation (in relative terms) is applied for all countries for costs and efficiency, while the impact on time at the airport is differentiated by NUTS I zone. This differentiation takes into account the current congestion levels of airports.
- The changes occur over a ramp up period of 3 years starting from the year selected for the application of the measure and remain stable (in terms of percentage) for the rest of the simulation.
- In order to provide a reference to the user, predefined values based on existing literature on the SESAR program⁵ are implemented in the interface. The reduction of time at the airport ranges from 1% to 7% (depending on the current level of delays of each airport); the non-fuel component of passenger costs is decreased by about 5% (resulting in a reduction of the total costs by about 2-3%), the fuel efficiency during airplane take-off and landing is implemented by a 10% reduction of fuel consumption.

⁵ http://www.sesarju.eu/

1.1.5 Efficiency standards & Flanking Measures

1.1.5.1 CO2 emission limits for HDV, LDV and cars

Policy set to simulate restrictive limits on CO2 emissions from new vehicles (cars and trucks)

Relevant information on the content of the measure and its implementation:

- The activation of this measure corresponds to improve the fuel efficiency of new vehicles purchased. The reduced fuel consumption results in reduced CO2 emissions from new vehicles.
- The implementation of limits on CO₂ emissions from new vehicles (for cars and vans only) is assumed in the reference scenario, according to current EU Regulations (for new cars 130 g/km in 2015 and 95 g/km in 2020, for new vans 175 g/km in 2017 and 147 g/km in 2020 on test cycle). This measure implies the application of further limits in the following years, namely:
 - for new cars 70 g/km in 2030 (-56% compared with the 2007 fleet average of 158.7g/km)
 - for new vans 110 g/km in 2030 (-46% compared with the 2007 fleet average of 203 g/km)
 - \circ for new heavy duty vehicles a reduction of 25% in 2030 compared with the 2007 fleet average CO₂ emissions.
- The changes occur over time with a predefined reduction of the fuel consumption factor.

1.1.5.2 Standards for controlling air pollution (CO, NOx, particulate matter)

Policy set to simulate restrictive limits on pollutant emissions from new vehicles (cars and trucks)

Relevant information on the content of the measure and its implementation:

 The activation of this measure corresponds to improve the pollutant emission factors (for CO, NOx, particulate matter) related to the emission standards after Euro VI (Euro VII and more).

- The implementation of standards for controlling air pollution is assumed also in the reference scenario, according to current EU Regulations for cars, vans and heavy duty vehicles and assuming a new reference value for later emission standards (entering in the fleet as of the year 2020 for cars and 2021 for trucks). This measure implies the application of more restrictive limits for these new standards (Euro VII and more).
- The changes occur over time with a predefined reduction of the pollutant emission factors for the new vehicle standards.
- The assumption is that from EuroVII emissions limits are reduced by 22% for CO, by 28% for NOx and 40% for PM. No changes are assumed for VOC

1.1.6 Transport Planning

1.1.6.1 **Promotion of energy efficiency commercial vehicles**

The policy is set to simulate the promotion of purchasing clean and energy-efficient commercial vehicles (LDV and buses) at urban level

- The activation of this measure corresponds to two changes. The first change is a reduction of average fuel consumption of LDVs and buses in the local distance band.
- The second change is an increase of the share of electric LDV which will be achieved by increasing the preferences in the logit function estimating the probability of a decision for an battery-electric LDV.
- The user can set the expected reduction of average fuel consumption: the same variation (in relative terms) is applied for all countries.
- The changes occur over a ramp up period of 2 years starting from the year selected for the application of the measure and remain stable (in terms of percentage) for the rest of the simulation.
- In order to provide a reference to the user a predefined 15% reduction of average fuel consumption of LDVs and buses is set in the local distance band, based on professional judgement.

1.1.6.2 City logistics

This policy includes various measures regarding urban freight distribution (e.g. urban consolidation centers) aimed at reducing the traffic of heavy duty vehicles through cities and metropolitan areas by means of the implementation of technical and planning measures.

Relevant information on the content of the measure and its implementation:

- The activation of this measure corresponds to the implementation of an increment of the average load factor of HDVs and of the average load factor of LDVs. The latter increment is expected to be larger than the former as the measure is focused on local distribution where light vehicles are predominantly used.
- The user can set the expected reduction of the average load factor by vehicle type: the same variation (in relative terms) is applied for all countries.
- The changes occur over a ramp up period of 5 years starting from the year selected for the application of the measure (in order to take into account the setup of facilities and services)and remain stable (in terms of percentage) for the rest of the simulation.
- In order to provide a reference to the user, predefined impacts based on professional judgement are implemented in the interface: an increment of 1% of the average load factor of HDVs and an increment of 15% of the average load factor of LDVs.

1.1.7 Research and Innovation & Other

1.1.7.1 Electromobility Road

The policy is set in order to accelerate the diffusion of vehicles with electric propulsion into the European car vehicle fleet.

The user interface allows the activation of the measure which changes a different set of parameters affecting the speed of diffusion of battery-electric vehicles.

Relevant information on the content of the measure and its implementation:

- The model simulates the purchasing decision of a certain fuel type based on costs of operation, purchasing costs and on user preferences (perception), which cover soft factors like image or safety of certain car propulsions.

- Activating this measure will increase automatically an improved user preference regarding battery-electric vehicles. The TPM starts in the year 2015. The level of change is predefined and the level of change has been tested in previous ASTRA projects (e.g. GHG-TransPoRD).
- The changes are implemented in 2015 and remain (in terms of percentage) for the rest of the simulation.
- The activation of this measure goes hand in hand with a faster decline of purchasing prices for battery electric vehicles than in the Reference Scenario. The model assumes economies of scale for the battery system with a learning rate of 10% starting in 2015. The underlying potential diffusion and cumulated production of BEV, HEV and PHEV is assumed to achieve a level of 65% of the total vehicle stock in 2050.
- In parallel, the activation of this measure induces additional R&D investments in economic sectors that are directly affected by this measure (e.g. Electronics, Chemicals). These investments are implemented starting with the predefined year 2015 and remain until the end of the simulation. The total amount of R&D investments is derived from the results of the GHG-TransPoRD project.
- Another assumption of the TPM is an accelerated establishment of a recharging infrastructure.

1.1.7.2 H2 Fuel Cell vehicles

The policy is set in order to stimulate the diffusion of H2 fuel cell vehicles into the European car vehicle fleet.

- The model simulates the purchasing decision for H2 fuel Cell vehicles based on costs of operation, purchasing costs and on user preferences which cover soft factors like image or safety.
- Activating this measure will increase automatically an improved user preference regarding H2 Fuel Cell vehicles. The TPM starts in the year 2015. The level of change is predefined and the level of change has been tested in previous ASTRA projects (e.g. GHG-TransPoRD⁶).

⁶⁶ www.ghg-transpord.eu

- The changes occur in the year 2015 and remain (in terms of percentage) for the rest of the simulation.
- The activation of this measure goes hand in hand with a faster decline of purchasing prices for H2 Fuel Cell vehicles than in the Reference Scenario. The model assumes economies of scale with a learning rate of 10% starting in 2015. The underlying potential diffusion and cumulated production is assumed to achieve a level of 65% of the total vehicle stock in 2050.
- In parallel the activation of this measure induces additional R&D investments in economic sectors directly affected by this measure. These investments are implemented as of 2015 and remain until the end of the simulation. The total amount of R&D investments is derived from the results of the GHG-TransPoRD project.
- Another assumption of the TPM is an accelerated establishment of a refilling infrastructure.

1.1.7.3 Compulsory safety standards in road vehicles

The policy is set to simulate the diffusion of a variety of technical safety systems in road vehicles such as driver assistance systems, seat belt reminder, eCall and vehicle-infrastructure interface.

- The activation of this measure corresponds to the implementation of a reduction of accident rates for cars and trucks. Different reductions are applied to urban and non-urban accidents rates and according to the seriousness of the accidents. It is assumed that the impact is stronger for injuries than for fatalities. The impact on material damages is assumed to be zero.
- In addition, the reduction of accidents and related costs produces a reduction of the insurance costs for road modes (car and truck).
- The user can set the expected reduction of the accident rates: the same variation (in relative terms) is applied for all countries.
- The changes occur over a ramp up period of 5 years starting from the year selected for the application of the measure (in order to take into account the setup

of infrastructures, technologies, etc.) and remain stable (in terms of percentage) for the rest of the simulation.

In order to provide a reference to the user, predefined impacts based on professional judgment are implemented in the interface. The risk factor for cars is reduced by 5% to 10% (respectively in urban and non-urban context), while the truck accident rate is reduced by 7% to 10% for fatalities and injuries respectively. The insurance costs are reduced by 5%.

1.1.7.4 Increased replacement rate of inefficient and polluting vehicles

The policy is set in order to stimulate the replacement of inefficient and polluting vehicles into the European car vehicle fleet

The user can activate this measure only for all EU member states together. He can define the point of time when the measure should start.

- The activation of this measure increases the probability of scrappage of fossil fuel based cars (despite CNG and hybrid electric vehicles) for each of the five car age cohorts by 25%.
- The policy can be implemented at a desired point of time and will be kept constant for the rest of the simulation.

Annex 4

Structure of the data input from TRANS-TOOLS model

The link with the TRANS-TOOLS model is implemented in the ASTRA-EC interface in two ways, as reported in the following paragraphs.

1.1.1 Variation of transport cost and transport time

The first link assumes the implementation in ASTRA-EC of the variation of transport costs and transport time on the basis of TRANS-TOOLS output while the evolution of transport demand is endogenously estimated in ASTRA-EC.

For activating this link, the ASTRA-EC model requires as input the relative variation of costs and times with respect to the year 2010. Absolute values are asked only for road tolls. The input is required for all modes of transport. As a whole the input consists of exogenous values for several ASTRA-EC variables (see table A4.1 below).

The level of detail of the TRANS-TOOLS output is not the same as ASTRA-EC (e.g. TRANS-TOOLS provides also link-based results). Also, TRANS-TOOLS runs make reference to one year whereas ASTRA-EC works with trend data over time until the year 2050. This means that the user needs to process TRANS-TOOLS results before being ready to use these results as exogenous input for ASTRA-EC.

The process to produce the data includes four steps:

- a)Run the TRANS-TOOLS model at different time thresholds (e.g. 2010, 2030 and 2050),
- b)Extract the data for transport time and transport costs and estimate the average values of the variables reported in table A4.1 at the required level of detail (e.g. country level),
- c) For each variable, interpolate the values obtained for the different time thresholds in order to estimate a value for each year between 2010 and 2050.
- d) For each variable, compute the index relative variation with respect to the year 2010 (index for the year 2010 = 1).

As mentioned above, tolls are required in absolute values rather than as indexes. Therefore, step d) of the sequence is not needed.

Variable	Description	Segmenta- tion	Unit
TRA_pass_TT_impact_toll_road[Co untry]	Value of road toll for cars over time	Country	Euro/ vehicle
TRA_pass_TT_impact_share_tolled _motorway[Country]	Index over time of relative variation of the share of tolled network by country	Country	dmnl
TRA_pass_TT_impact_bus_fare[Co untry]	Index over time of relative variation of bus fare by country	Country	dmnl
TRA_pass_TT_impact_train_fare[C ountry]	Index over time of relative variation of train fare by coun- try	Country	dmnl
TRA_pass_TT_impact_Air_cost[Co untry, Country_2]	Index over time of relative variation of air user cost by OD pair at country level	Country to country	dmnl
TRA_fre_TT_impact_road_cost[Co untry]	Index over time of relative variation of truck production cost by country	Country	dmnl
TRA_fre_TT_impact_toll_cost[Cou ntry]	Value of road toll for trucks over time	Country	Euro/ vehicle
TRA_fre_TT_impact_rail_cost[Cou ntry]	Index over time of relative variation of freight rail cost by country	Country	dmnl
TRA_fre_TT_impact_IWW_cost[Co untry]	Index over time of relative variation of freight inland wa- terways cost by country	Country	dmnl
TRA_fre_TT_impact_SHIP_cost[Co untry, Country_2]	Index over time of relative variation of freight maritime cost by country	Country	dmnl
INF_TT_impact_time_road[nuts1]	Index over time of relative variation of average travelling time by road by NUTS I	NUTS I	dmnl
INF_TT_impact_time_road_interna t[Country, Country_2]	Index over time of relative variation of average travelling time by road by OD pair at country level	Country to country	dmnl
INF_TT_impact_time_rail[nuts1]	Index over time of relative variation of average travelling time by rail by NUTS I	NUTS I	dmnl
INF_TT_impact_time_rail_internat [Country, Country_2]	Index over time of relative variation of average travelling time by rail by OD pair at coun- try level	Country to country	dmnl
INF_TT_impact_IWW_terminal_ti	Index over time of relative	Country	dmnl

Table A4.1: Description of input variables format from TRANS-TOOLS

Variable	Description	Segmenta- tion	Unit
me[Country]	variation of average freight Inland waterways terminal time by country		
INF_TT_impact_train_terminal_ti me[Country]	Index over time of relative variation of average freight train terminal time by country	Country	dmnl
INF_TT_impact_access_time_air[n uts1]	Index over time of relative variation of average passenger access and in airport time by NUTS I	NUTS I	dmnl
INF_TT_impact_ship_terminal_tim e[Country]	Index over time of relative variation of average freight ship terminal time by country	Country	dmnl

It is worth to note that, even if this linkage with TRANS-TOOLS is activated, ASTRA-EC will use the endogenous values of tolls until the year 2010. Therefore, it is recommended to check the consistency between the average values of tolls estimated from TRANS-TOOLS and those implemented in ASTRA-EC (provided in the file "input_ExogTT.xls" for convenience) in order to avoid undesired spurious variations during the simulation.

Once the TRANS-TOOLS output has been processed according to the steps above, it is ready to be imported in the ASTRA-EC model through the interface. The interface functionality (described in chapter 4.5.1) opens an excel file where data should be stored (each variable in a different spreadsheet). In this file there are values associated to each variables but they are just for illustrative purpose (except for road tolls where the reference scenario values are reported).

1.1.2 Variation of transport cost, transport time and transport demand

The second link consists of implementing in ASTRA-EC the variation of transport costs, transport time and transport demand on the basis of the TRANS-TOOLS output. In this case, some feedbacks on transport demand are not activated as explained in section 5.4).

If this type of linkage is chosen, the required input from the TRANS-TOOLS model involves a huge amount of data. All the variables in table A4.1 are needed plus many

other variables regarding transport demand⁷. The number of these variables is large because the transport demand is segmented by freight / passenger, by mode and by context (intra – NUTS II distance bands, national or international).

The steps to prepare the data are the same as for the first link:

- a)Run the TRANS-TOOLS model at different time thresholds (e.g. 2010, 2030 and 2050),
- b)Extract the data for transport time and transport costs and estimate the average values of the needed variables (see below) at the required level of detail (e.g. country level),
- c) For each variable, interpolate the values obtained for the different time thresholds in order to estimate a value for each year between 2010 and 2050.
- d) For each variable, compute the index relative variation with respect to the year 2010 (index for the year 2010 = 1).

Again, tolls are required in absolute values rather than as indexes. Therefore, step d) of the sequence is not needed.

The list of variables required as input by the ASTRA-EC model and their segmentation is reported in the exogenous file "input_ExogTT-All.tab" annexed to the model and the interface. In this file there are values associated to each variables but they are just for illustrative purpose.

Given the number of variables it is not practical to use Excel to prepare the input data. The user should produce the .tab file, then from the interface the file can be automatically imported in the ASTRA-EC model.

⁷ The list of variables required as input by the ASTRA-EC model and their segmentation is reported in the exogenous file "input_ExogTT-All.tab" annexed to the model and the interface.

Annex 5

Tutorial

This tutorial explains step by step how to simulate a policy measure and read results using ASTRA-EC. The explanation is made, using the measure "Urban road pricing"; the procedure is the same for all other measures. Also, how to read results is shown for some indicators.

The tutorial is made of two main sections. Section 1 explains how to simulate a measure, section 2 describes how to display results.

1 Simulation of a policy measure

Start the Interface by double-clicking the "ASTRA-EC_model_interface.vpa" file (see section 1.2 of the user guide).

Click **Enter** in the middle of the screen and wait while the model and the utility are loading. At the end, the HOME screen will be shown.


ASSIST - ASsessing the Social and economic linguistic of part and future Sustainable Trans HOME	iport policy in Europe	
	ASTRA-EC model	
	ASsessment of TRansport strategies	S
STRUCTURE		OUTPUT
To explore the model structure, the linkages between modules, the equations and relations between variables	To implement the policy measures (individually or impackages) and test the impacts of exogenous scenarios (e.g. population growth)	To analyse the output of the simulations with reference to transport, economic, environmental and social indicators
		Fraunhofer

To set up a new scenario, click the **Simulation** button:

The SIMULATION screen will be opened. Let's assume you want to run a policy scenario, which includes urban pricing. This policy is part of the Pricing domain (the full list of measures and their classification by domain is provided in table 4-1 of the user guide), thus click the >> button beside "Pricing", in the "Modify policy options" frame:

ASSST - ASsessing the Social and economic legacts of part and future Sustainable Tra	nsport policy in Europe		- 0
Modify policy options			
Pricing Advantion Infrastructure (Transport & Inform	ation/Communication)	Efficiency standards & Flanking Measure Transport Planning Research and Innovation & Other	es
Change exogenous alterna Fiel price tend ? Emission factors by vehicle type ? Edemalty cost ?	PREPARE ACO DATA PREPARE ACO DATA POButant emissions and accidents CO2 emissions (euro/torn)	PHEPHARE ACD DATA 65 25 25 2,050	
External trends			
	SIMULATE WITH SAVELIST	SIMULATE WITHOUT SAVELIST	CANCEL

In order to set up the urban pricing policy you have to:

- 1. Activate the policy "Urban road user charging / access restrictions" by ticking the checkbox beside the name of the policy.
- 2. Set the year of implementation (e.g. to 2030), scrolling the slider or directly typing the value in the box.
- 3. Choose how to set the values for the variable linked to the policy. You can choose to set detailed values by zone and year or to set a unique value for all countries and for the whole simulation period (from the year selected in the previous step until the year 2050):
- Continue with section 1.1 to see how to implement detailed values, or
- Jump to section 1.2 in order to see how to set a unique value.

ST - ASsessing the Social and economic Impacts of past and futu	re Sustainable Transport policy in Europe				
	PRICING POLICIES (1/2)				
infrastructure Charging /	P Urban road user ch	arging / access restrictions			
access Resulctions Schemes			Year of implementation	C PREPARE	ADD DATA
	Car road charging s	schemes			
	7		Year of implementation	2113 2000 2000 C PREPARE C euroWatt	ADD DATA
	Railway infrastructure o	tharges directive (2001/14/EC	a		
	7	T Passenger	Year of implementation	2013 2000 2000 C PREPARE	ADD DATA
		□ Freight	Year of implementation	2013 2016 2000 C Eurotrain-km	ADD DATA
NEXT Pricing policies					
OTHER POLICIES	SIMULATE		SMULATE WITHOUT SAVELIST	RESET	

1.1 Implementing detailed input

Select the first radio button, beside **Prepare**, then click **Prepare**. The Excel file "input_UrbanRoadCharge.xls"¹ will be opened.

frastructure Charging /	🖓 Urban road	user charging / access restrictions			
ccess Restrictions Schemes	5		Year of implementation		DD DATA
	Car road d	araina schemes			
	5		Year of implementation :	2013 2000 2000 C PREPARE A	DD DATA
	Railway infrast	ructure charges directive (2001/14/E	-C)		
	7	Passenger	Year of implementation	2013 2000 2000 C PREPARE A	DD DATA
		□ Freight	Year of implementation	PREPARE A	DO DATA

Most likely, when the file is opened a warning is issued on the upper part of the screen that macros are not activated. You have to activate macros by clicking on the button **Option** and then select activate.



¹ The Excel files used to provide detailed input are stored in the subfolder "interface"

In the first sheet of the file, named "list of the variables", the policy is described and the used variables are listed. A legend of the subscripts involved in the equation of the variables is also presented.

A A	В	c	D	E		F	G	н	1		J		K	L		M	N
Transport policy	Car urban road charge scheme / acc	ess restriction															
Category	Pricing																
Sub-Category	Infrastructure Charging / Access Restrictio	ns Schemes															
10000000000000000000000000000000000000																	
The policy is set t	o charge car vehicles for entering in a urban	area.															
The charge is app	lied based on trips (euro/trip) and can be d	fferentiated by NUTS I zone (variable 78	A pass	urban ro	d charae	1.											
The charge applie	s only to trips within a urban area: therefor	e, the share of trips in urban context by	NUTSIL	one and di	tance bar	d is estim	ated o	the ba	sis of th	e clas	sificatio	n by 'U	rban-r	ural type	logy' o	FURC	ISTA
the charge obbits	song to the main a broan area. mercroi	e, the share of this in broad context of	101211		Number own	a la catili	area o	1110 00	111 01 01	c ciux	mound	101 0	- Walt 1	anan cype	1001 0	i LVIII	1.2110
Modify in the cell	helow the name of the file to save the innu	t of the car mising policy (default name	innut He	hanRoadC	arma tab)												
the cent	below the name of the file to save the input	a contraction pricing policy (default name	mpot_On	Jannoauc	angertab)												
U: (Progetti (11)	io-Assist (Lavoro (WP4 (AstrA-EC interfac	e(ASTRA-EC_test(input_OrbankodaCh	arge.tab														
1	100000000000000000000000000000000000000																
Sheet	Input Variables			Create	÷												
01	TRA_pass_urban_road_charge			the Tab	file												
2																	
1																	
Legend of the su	bscripts																
8 Nuts1	NUTS I zones for EU29 countries (95 zones)																
	AT1 - Ostösterreich	Ostösterreich															
)	AT2 - Südösterreich	Südösterreich															
6	AT3 - Westösterreich	Westösterreich															
5	BE1 - Région De Bruxelles-Capitale	Région De Bruxelles-Capitale															
	BE2 - Vlaams Gewest	Vlaams Gewest															
	BE3 - Région Wallonne	Région Wallonne															
3	BG3 - Severna I Iztochna Bulgaria	Severna I Iztochna Bulgaria															
5	BG4 - Yugozapadna I Yuzhna Tsentralna Bulgaria	Yugozapadna I Yuzhna Tsentralna Bulgaria															
7	CYO - Kibris	Kibris															
B	C20 - Česká Republika	Česká Republika															
<u>.</u>	DEL Buden Millimenhous	Reden attendents have															_

The chosen policy is affected only by the variable "TRA_pass_urban_road_charge", so to define the values of the charges go to the sheet "01"².

In the sheet "01" you can specify the charge values (in Euro/trip as specified at the top of the sheet, in the cell B4) for each zone (NUTS1) and for each year you want³. To provide ASTRA-EC with a complete dataset (and avoid warning messages) the sheet provides values for the whole modelled period from 1995 to 2050. However, values from 1995 to 2010 are not changeable (for this policy all values are zero). Of course you can also paste data from another Excel sheet you may have prepared in advance.

² Other policy measures are more complex and the input is defined in more variables. In that case the Excel file will include more sheets and the procedure explained here should be repeated in all relevant sheets.

³ Note that if you specify a charge for some years before the initial year you set previously in the PRICING POLICIES screen the model will not complain, but the specified charges will be disregarded, i.e. the initial year setting prevails on the data of the Excel sheet.

Once you have finished to code the charges in the sheet "01", click the **Create** button in the cell B1 or, alternatively, go back to the first sheet and click the **Create the Tab file** button in the upper left side of the screen. In case of more complex policies, where there are more sheets available for setting the input you should complete the definition of the input in each sheet before clicking the button.

Z A CONTRACTOR		-		_		inpu	r_UrbanRoa	dChargexis	(modalità co	mpatibilità	- Microso	ft Excel					_					×.
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1 back to Main menu	Country	1																				
2	Create	1																				
3 Variable :	TRA.	s_urban_re	oad_charge																			
4 Unit :	euro	100			-																	
5 Nuts1	- P1 '	1176	1997	1998	1999	2000	2001	2002	2008 2	204 200	5 200	6 200	7 20	200	9 2010	2011	201	2 2013	2014	2013	2016	201
6 BE1 - Région De Bruxelles-Capitale	- X		0 0	0	> 0	10000	0 0	0	0	0	0	0	0	0	0	0 0	0	0 1	0	0	0	2
7 BE2 - Viaamo Gewest	- N -	- 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
8 BE3 - Région Wallonne		100	0 0		0		0 0	0	0	0	0	0	0	0	0	0 (0	0	1 0	0	0	3
9 BG3 - Severna I Iztochna Bulgaria		0 0	0 0	0	<u>)</u> 0		0 0	0	0	0	-0	0	0	0	0	0 1	0	0) 0	0	0	2
 BG4 - Yugozapadna I Yuzhna Tsentralna Bulgaria 		0 0	0 0	0	0	1	0 0	0	0	0	0	0	0	0	0	0 (0	0 1) 0	0	0	3
11 CZO - Ceská Republika		0	0 0	- 0	0		0 0	0	0	0	0	0	0	0	0	0 0	0	0 1	1 0	0	0	2
12 DKD - Danmark		0	0 0		0 0		0 0	0	0	0	0	0	0	0	0	0 0	0	0	1 0	0	/ 0	3
13 DE1 - Baden-Württemberg		0 0	0 0		2 0	-	0 0	0	0	0	0	0	0	0	0	0 0	0	0 1	1 0	0	0	2
14 DE2 - Bayern		0 0	0 0) <u> </u>		0 0	0	0	0	0	0	0	0	0	0 (0	0	0 0	0	0	0
15 DE3 - Berlin	0.4	0 0	0 0		× 0	<u>15 - 3</u>	0 0	F 0	0	0	0	0	0	0	0	0 (0	0 1	1 0	0	/ 0	3
16 DE4 - Brandenburg		0 0	0 0	0	0	-	0 0	0	0	0	0	0	0	0	0	0 0	0	0	0	0	0	2
17 DES - Bremen		0, (0 0	0	0		0 0	0	.0	0	0	0	0	0	0	0 (0	0 1) 0	0	0	2
18 DE6 - Hamburg		0	0 0		X 0		0 0	0	0	0	0	0	0	0	0	0 (0	0 1) <u> </u>	0	0	3
19 DE7 - Messen		0 (0 0		0		0 0	0	0	0	0	0	0	0	0	0 0	0	0 1	2 0	0	0	2
20 DEB - Mecklenburg-Vorpommern		0 0	0 0	0	2 0	1 0	0 0	0	0	0	0	0	0	0	0	0 (0	0 1	1 0	0	0	0
21 DE9 - Niedersachsen		0 (0 0		y 0	1	0 0	0	0	0	0	0	0	0	0	0 0	0	0	0 0	0	0	2
22 DEA - Nordrhein-Westfalen		0 0	0 0		x 0		0 0	0	0	0	0	0	0	0	0	0 (0	0 1	1 0	0	0	2
23 DEB - Rheinland-Pfalz		0 (0 0	0	0		0 0	0	0	0	0	0	0	0	0	0 0	0	0 1	1 0	0	0	3
24 DEC - Searland		0 (0 0	0	0		0 0	0	0	0	0	0	0	0	0	0 0	0	0 1	0	0	0	3
25 DED - Sachsen		0 (0 0		0		0 0	0	0	0	0	0	0	0	0	0 1	0	0 1	1 0	0	0	2
26 DEE - Sachsen-Anhalt		0 (0 0	0	0		0 0	0	0	0	0	0	0	0	0	0 1	0	0	0	0	- 0	3
27 DEF - Schleawig-Holstein		0 0	0 0	0	2 0	1	0 0	0	0	0	0	0	0	0	0	0 0	0	0 1	0 0	0	0	3
28 DEG - Thüringen		0 0	0 0		0	1	0 0	0	0	0	0	0	0	0	0	0 0	0	0	1 0	0	0	2
29 EEO - Eesti		0	0 0		0		0 0	0	0	0	0	0	0	0	0	0 0	0	0 1	1 0	0	0	3
30 IED - Ireland		0	0 0		0		0 0	0	0	0	0	0	0	0	0	0 0	0	0	1 0	0	0	2
1 GR1 - Voreia Ellada		0 0	0 0		0 0	-	0 0	0	0	0	0	0	0	0	0	0 0	0	0 1	1 0	0	0	9
12 GR2 - Kentriki Ellada		0 0	0 0	0	γ 0	1 2	0 0	0	0	0	0	0	0	0	0	0 (0	0 1	0 0	0	0	0
33 GR3 - Attiki		0 (0 0		× 0		0 0	0	0	0	0	0	0	0	0	0 (0	0 1	0 0	0	0	3
34 GR4 - Nisla Algalou, Kriti		0 (0 0	0	0	ļ	0 0	0	0	0	0	0	0	0	0	0	0	0 1) O	0	0	9
15 ES1 - Norbeste		0 (0 0	0	0	-	0 0	0	0	0	0	0	0	0	0	0 (0	0 1	0	0	0	0
36 E32 - Noreste	4	0 (0 0	0	0	-	0 0	0	0	0	0	0	0	0	0	0 (0	0 0	0	0	/ 0	3
37 ES3 - Comunidad De Madrid		0 (0 0	0	0		0 0	0	0	0	0	0	0	0	0	0 (0	0 1	0	0	/ 0	5
38 E54 - Centro (E)	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 -
• • • • Ist of the variables 01		10 L	4	16 (A)			Sec. 5		A			0	12	100	22	10 m		191	1	10		
Provine BLOC SCORE 2																		1.18	1 1 T T LOD	(m) (m)	0	+

	С	D	E	F	G	Н	
scheme / acce	ess restriction			1		1	
Access Restrictio	ns Schemes						
tering in a urban	area.						
i p) and can be di	fferentiated by NUTS I zone	e (variable TRA_pass_	urban_roa	d_charge).			
n area: therefor	e, the share of trips in urban	context by NUTS II z	one and dist	ance band is estim	ated	on the bas	sis of
to save the inpu	t of the car pricing policy (de	efault name input_Ur	banRoadCh	arge.tab).			
TRA-EC interfac	e\ASTRA-EC_test\input_Un	banRoadCharge.tab)				
oles			Create				
narge			the Tab fi	le			
			_ lb	N			
(22			- S	1			
s (95 zones)	Octöstorroich		<u> </u>	<i>(</i>			
	Südösterreich						

By clicking the **Create** button, a macro will read the content of the sheets and create in the working directory the file "input_UrbanRoadCharge.<u>tab</u>", that will be automatically converted to the .<u>vdf</u> format. A message will confirm the successful operation.



You can always change the name to the .vdf file, but if for any reason you want the macro to save the file with another name you can just modify the name in cell A10 of the sheet "list of the variables" (text in red).

	7121	Jan Ol				
	А	В	С	D	E	F
1	Transport policy	Car urban road charge scheme / acces	ss restriction			
2	Category	Pricing				
3	Sub-Category	Infrastructure Charging / Access Restriction	ns Schemes			
4						
5	The policy is set to	o charge car vehicles for entering in a urban a	area.			
6	The charge is appl	ied based on trips (euro/trip) and can be dif	ferentiated by NUTS I zone (variable TRA_	pass_	urban_road_	charge
7	The charge applies	s only to trips within a urban area: therefore	, the share of trips in urban context by NU	TS II z	one and distar	ice ban
8				_		
9	Modify in the cell	below the name of the file to save the input	of the car pricing policy (default name inp	ut_Ur	banRoadChar	ge.tab).
10	U:\Progetti\11p0	6-ASSIST\Lavoro\WP4\ASTRA-EC interface	\ASTRA-EC_test\input_UrbanRoadCharg	je.tab		
11						
12						
13	Sheet	Input Variables			Create	
14	<u>01</u>	TRA_pass_urban_road_charge			the Tab file	
15					the rub file	

Close the Excel file <u>without saving</u> (so that the default values keep being available for the next time).

Again in the PRICING POLICIES screen, click the **Add data** button.

nfrastructure Charging /	🖓 Urban road us	er charging / access restrictions			
ccess Restrictions Schemes	7		Year of implementation	2013 2000	2000 PREPARE ADD DATA
	Car road charg	ging schemes			
	7		Year of implementation	2013 2020	2000 C PREPARE ADD DATA
	Railway infrastruc	ture charges directive (2001/14/E	C)		
	7	Passenger	Year of implementation	2013 [2020]	2010 C PREPARE ADD DATA
		☐ Freight	Year of implementation	22113 2016	C PREPARE ADD DATA

A file-open dialog will ask you to select which .<u>vdf</u> file to load. Select "input_UrbanRoadCharge.vdf" file and click **Open**. The preparation of the detailed measure input is complete.

	-		1.5.0		
ganizza • Nuova cartella					1
📙 Coordinamento	*	Nome	Ultima modifica	Tipo	
🗼 Corrispondenza		FOT_EV.vdf	22/08/2013 18:48	File VDF	
👗 Lavoro		FOT_IV.vdf	01/10/2012 19:19	File VDF	
👢 Note tecniche		input_ExogTT-All.vdf	15/10/2013 12:24	File VDF	
🗼 Rapporti	-	input_UrbanRoadCharge.vdf	15/10/2013 16:16	File VDF	
🐌 WP1	20	LDV_IV2.vdf	03/05/2013 09:28	File VDF	
👢 WP2		LDV_IV3.vdf	03/05/2013 09:28	File VDF	
🗼 WP3		MAC_con_EV.vdf	03/09/2013 10:09	File VDF	
📜 WP4		MAC_con_IV.vdf	28/05/2013 16:15	File VDF	
👢 ASTRA-EC interface		MAC_emp_EV.vdf	22/08/2013 18:48	File VDF	
📕 _old_		MAC_emp_IV.vdf	22/07/2013 10:14	File VDF	
ASTRA-EC_test		MAC_gdp_EV.vdf	30/08/2013 09:58	File VDF	
🐌 interface		MAC_gdp_IV.vdf	22/07/2013 10:14	File VDF	
👢 immagini	Ŧ	•			
Nome file: inpu	rt Urb	anRoadCharge.vdf	- Datasets	(Runs)	

1.2 Implementing a simple input

To implement a fixed charge for all countries and for all years (after the initial year) select the second radio button, beside "euro/trip" and scroll the next slider to set the desired value (or type the value directly in the box).

ST - ASsessing the Social and economic Impacts of past and futur	Sustainable Transport policy in Europe		
SSIS	PRICING POLICIES (1/2)		
nfrastructure Charging /	Utban road user charging / access restrictions		
Access Restrictions Schemes	2	Year of implementation	Decretion and the second secon
	Car road charging schemes		du du
	×	Year of implementation	2113 2009 2009 C PREPARE ADD DATA
	Railway infrastructure charges directive (2001/14/	EG)	
	Passenger	Year of implementation	2013 2008 2009 PREPARE ADD DATA
	□ Freight	Year of implementation	2013 2016 C PREPARE ADD DATA g eurotrain-km
NEXT Pricing policies			
OTHER POLICIES	SIMULATE WITH SAVELIST	SMILLATE WITHOUT SAVELIST	RESET

1.3 Simulate the measure

The procedure described above can be repeated for as many measures as you want, to include different policies in the policy scenario. After having set up all the measures, click the **Simulate with savelist** button in the POLICY screen or in the SIMULATION screen.

	Modify policy options			
>>	Pricing		**	Efficiency standards & Flanking Measures
>>	Taxation		33	Transport Planning
>>	Infrastructure (Transport & Information/Comm	nunication)	33	Research and Innovation & Other
>>	Internal Markets			
	vel price trend mission factors by vehicle type demaility cost	PREPARE ADD DATA PREPARE ADD DATA Publicant emissions and accidents CO2 emissions (eurotom)		PREFARE ACO DATA 85 25 1995 2,050

A file-save dialog will ask you to specify a name and a location for the output file. Type the desired name (e.g. "test_policy_1") and click **Save**.

nizza • Nuova cartella				
Lavoro		Nome	Ultima modifica	Tipo
 Note tecniche 		L interface	14/10/2013 10:23	Cartella di fi
A. Rapporti		ASTRA EC Sc Reference.vdf	10/10/2013 10:12	File VDF
L WP1	190	ASTRA_EC_Sc_Reference_1year.vdf	09/10/2013 17:05	File VDF
L WP2	31	ASTRA_EC_Sc_Reference-30-09.vdf	30/09/2013 15:02	File VDF
L WP3		D ENV-EV.vdf	07/10/2013 12:25	File VDF
1. WP4		FOT_EV.vdf	22/08/2013 18:48	File VDF
ASTRA-EC interface		FOT_W.vdf	01/10/2012 19:19	File VDF
		input_ExogTT-AlLvdf	15/10/2013 12:24	File VDF
ASTRA-EC_Test		input_UrbanRoadCharge.vdf	15/10/2013 16:16	File VDF
immanini		f Internet	03/06/2003 00:25	City HDC
Nome file: test_policy_1				
Salva come: Datasets (Runs)				

A box will pop up to inform first that the simulation is being set up:



And then that the simulation is proceeding (time is updated from 1995 to 2050 in five years steps):



At the end of the simulation the OUTPUT screen of the interface will be automatically shown.

2 Analyse the outcomes

At the end of a simulation you will be moved to the OUTPUT screen and the new scenario will be shown in the "Loaded runs" box in the lower left side of the screen.



From this screen you can:

- verify the policy changes (section 2.1);
- look at a set of key indicators (section 2.2);
- look at several indicators in different domains (section 2.3)
- export all indicators to analyse them with another program (section 2.4).

2.1 Verify policy changes

Policy changes can be checked against any other scenario, in most of the cases you will want to check changes with respect to the reference scenario. First you have to load the reference scenario dataset. Click the **Change** button in the left-lower corner of the screen.



In the Dataset Control dialog, select the ASTRA_EC_Sc_Reference scenario (you can resize the window by dragging the borders to read the full names of the datasets). Click the >> button, then **Close**.





Click on the Verify policy changes button.

Select the policy measure you want to check by clicking on the correspondent button in the left side of the screen. Values of the relevant variables will be shown in the right side of the screen (e.g. if we have simulated urban road charge, the values of the activation switch, the initial year and the value of the charges will be shown for each combination of subscripts – NUTS 1 zones for this policy). For each variable/combination, values are displayed in two lines: one for reference scenario, the other for the policy scenario (the order is the one shown in the loaded run box). By comparing values you can check if the run was made applying the desired changes.

PSSIST			Urban road user charging			EXPORT	PRINT
			Time (Year)	1995	2000	2005	2010
icing		Internal Markets	Switch urban pricing	0			
Urban road user charping		Conditions for truck drivers	Switch_urban_pricing	1			
Car and charging achieves		No metric firms on exhering	-				
Car road charging schemes		No restrictions on cabotage	Switch_urban_pricing_input	0			
Halway infra	5	Community railway liberalisation	Switch_uroan_pricing_input	0			
Ralway infra	ht	Integration of inland waterways	Year urban pricing	2.020			
EUROW ective		Blue Belt	Year urban pricing	2,030			
Internalisation - pass		Single European Sky II					
Internalisation of costs - treight			TRA_pass_urban_road_charge_policy[BE1]	0	0	0	0
		Efficiency standards	TRA_pass_urban_road_charge_policy[BE1]	0.2	0.2	0.2	0.2
ation		CO2 emission limits	TRA pass_urban_road_charge_policy[BE2]	0.7	0.7	0.2	0.2
Ensure Treation Direction	-	Disadarda far ar anheira	TRA pass urban road charge policy[BE3]	0	0	0	0
Energy savasin Directive		oranidarius fur ar poweren	TRA pass urban road charge policy[BE3]	0.2	0.2	0.2	0.2
Vehicle taxation		Transport Planning	TRA_pass_urban_road_charge_policy[BG3]	0	0	0	0
CO2 certificate			TRA_pass_urban_road_charge_policy[BG3]	0.2	0.2	0.2	0.2
Feebates		Energy efficiency commercial veh.	TRA_pass_urban_road_charge_policy[BG4]	0	0	0	0
		City logistic	TRA_pass_urban_road_charge_policy[BG4]	0.2	0.2	0.2	0.2
astructure		Barrish and barries and	TRA pass urban road charge policy[CZ0]	0.2	0.2	0.2	0.2
TEN-T projects accelerated		Research and Innovation	TRA pass urban road charge policy[DK0]	0	0	0	0
Internation Incal PT services		Electromobility Road	TRA_pass_urban_road_charge_policy[DK0]	0.2	0.2	0.2	0.2
sequences and a second		H2 Fuel Cell vehicles	TRA_pass_urban_road_charge_policy[DE1]	0	0	0	0
		Compulsory safety standards	TRA_pass_urban_road_charge_policy[DE1]	0.2	0.2	0.2	0.2
		Destaurant of a first state	TRA_pass_urban_road_charge_policy[DE2]	0	0	0	0
		Replacement rate of inefficient vehicles	TRA pass urban road charge policy[DE2]	0.2	0.2	0.2	0.2
			TRA pass urban road charge policy[DE3]	0.2	0.2	0.2	0.2
.oaded runs:	Comparison of in	puts	TRA pass urban road charge policy[DE4]	0	0	0	0
STRA EC Sc Reference	or the first two so	enanos ioadeo.	TRA_pass_urban_road_charge_policy[DE4]	0.2	0.2	0.2	0.2
est_pokcy_1	Each variable is reco	ated takes in the table	TRA_pass_urban_road_charge_policy[DE5]	0	0	0	0
	to facilitate the comp	area once in ore labore	[TRA_pass_urban_road_charge_policy[DE5]	0.2	0.2	0.2	0.2
	the order of the rows	effects the order of the	TRA pass urban road charge policy[DE6]	0.2	0.2	0.2	0.2
	loaded scenarios.		rior_pass_uroan_road_enarge_policy[DE6]	0.2	0.2	0.4	0.4

2.2 View the key indicators

Click the Key indicators button.



The page reporting the key indicators will be opened showing results of the first key indicator at the country level in tabular form (if you have loaded more runs results for all runs will be displayed).

The tabular form is usually the most readable, but if you want to look at results in graphical form click on the **Graph** button.

Select the spatial level for the list of indicators							
75515 EU27 EU15 EU12		TABLE GRAPH	Var. from Ref. Scenario			EXPORT	PRINT
ar passenger transport activity by origin country o Pionlyear - TRA_pass_Yearly_Origin_plan_per_Mode_per_Country	35	Time (Year)	2000 ein_pkm_per_Mode_per_C	2005 ountry[Car,Cour	2010 try]* Runs:	2015 test_policy_1	2020
uck freight transport activity by origin country		[Car,AT]	n_pkm_per_Mode_per_Co 66,933	72,561	74,548	76,649	82,227
> Tkm/year - TRA_fre_Yearly_Ongin_Rom_per_Mode_per_Country		[Car,DK]	48,246	50,327	50,115	51,903	55,756
CP	39	[Car,ES] [Car,FI]	291,844 58,644	339,488 62,671	356,307 64,291	359,784	385,654 71,253
		[Car, FR] [Car, UK]	694,733 620,408	657,384	737,588 663,952	736,893 686,508	780,985
O2 transport emissions (tank-to-wheel) 00 tans/year - EMV_Tank_to_Wheef_Yearly_emissions_per_EC	35	[Car,EL]	845,483 64,772	870,295 72,767	869,931 73,985	901,237 77,832	907,089 86,845
nployment	35	[Car,IE] [Car,IT]	38,600 673,709	47,043 734,154	52,087 732,546	56,689 740,547	63,157 779,150
30 Pera - MAC_emp_Employment_per_EC		[Car,NL] [Car,PT]	133,937 70,939	146,066 79,847	146,506 78,046	150,892 80,788	159,952 86,292
		[Car,SE] [Car,BG]	92,551 26,927	99,755 29,805	102,993 33,476	106,705 40,986	112,998 45,228
		[Car,CH] [Car,CY]	78,512 3,443	83,950 4,122	88,917 4,915	95,070 5,828	105,24
		[Car,CZ] [Car,EE]	58,546 6,068	68,534 7,366	72,211 8,509	73,088 8,946	80,298 9,960
		[Car,HU] [Car,LV]	47,940 10,017	53,071 12,499	57,477 14,198	62,881 15,210	68,114 16,432
		[Car,LT] [Car,MT]	21,393 1,558	25,112 1,731	27,174 1,902	28,781 2,152	30,971 2,332
		[Car,NO] [Car,PL]	52,321 170,503	58,154 223,218	63,747 300,016	69,209 334,715	79,286 366,75
		[Car,RO] [Car,SI]	52,313 20.088	63,377 22,726	76,263 25,734	85,915 26,277	92,275 28,061
Loaded runs: Select the zones and modes		[Car,SK] [Car,LU]	19,592 5,043	23,815 5,686	29,298 6,034	31,008 6,524	32,813 7,276
est_polcy_1							
22 02 02/02/02							
Other output indicators							

Vensim limits to 16 the plotted combinations of subscripts for the selected variables. If the dataset includes more combinations, a warning message will pop up.



To reduce the number of subscripts combinations (and therefore to make the graph readable), you should reduce the number of combinations in the dataset. For instance, you can select only a few countries. To do so, click on the **Country** button.



Click **Clear all sel** to clean the list of all countries. In the Available Subscript Constants box select the desired country/ies (e.g. Spain) then click the >> button. Finally click **Close**.



The graph will displayed only for the selected country (if more scenarios are loaded one line for each scenario will be drawn).



To see the percentage variation with respect to the Reference scenario, click the **Var. from Ref. Scenario** button and then again the >> button.

ASSIST - ASsessing the Social and economic Impacts of past and future Sustainable Transport policy in	Europe						- 0 - X
PSSIST Select the spatial level for the list of indicators		TABLE GRAPH \	ar from Ref. Scenario			EXPORT	PRINT
Car passenger transport activity by origin country Mic Plentyear - TRA_pass, Yearly_Ongin_plant_per_Micde_per_Country		Time (Year) "TRA_pass_Yearly_Origin_pk TRA_pass_Yearly_Origin_pk		2000 Country[Car,Cour	2005 atry]" Runs:	2010 test_policy_1	2015
Truck freight transport activity by origin country Mo Timiyear - TPA, Ing Yearly, Origin, Isin, Jee, Mode, per, Country	(''')	[Car,BG] [Car,CY] [Car,CZ]	49,089	27,055 3,444 58,349	31,171 4,146 67,757	35,068 4,967 71,070	41,575 5,915 72,258
GDP Mia Euro'year - MAC_pdp_Gross_Domeste_Product	33	[Car,EE] [Car,HU] [Car,LV]	5,411 44,979 7,922	6,067 47,984 10,020	7,366 53,405 12,508	8,509 58,215 14,228	8,953 63,753 15,248
CO2 transport emissions (tank-to-wheel) 1000 tons/year - ENV_Tank_to_Wheel_Yearly_emissions_per_EC	46	[Car,LT] [Car,MT] [Car,PL]	17,025 1,376 128,016	21,396 1,558 170,502	25,092 1,715 223,215	27,092 1,868 299,875	28,809 2,122 334,493
Employment 1000 Perz - MAC_emp_Employment_per_EC	33	[Car,RO] [Car,SI] [Car,SK]	42,032 17,213 15,838	52,331 20,087 19,009	63,442 22,731 22,181	74,627 25,751 27,530	81,340 26,330 29,302
Select the zones and modes							
test_polcy_1							
Other output indicators							
CHANGE TRA ECO ENV	SOC	•					,

Click the **<< back** button to return to the absolute values.

ASSIST - ASsessing the Social and economic Impacts of past and future Sustainable Transport policy in E	urope						- 0' X
I OUTPUT / KEY INDICATORS (variation from	Reference Scenario) - (COUNTRY					
Select the spatial level for the list of indicators							
PSSIST EU27 EU15 EU12		<<	lack			EXPORT	PRINT
Car passenger transport activity by origin country and mode % - TRA_passa_Yearly_Chigin_phm_per_Mide_per_Country_var	35	Time (Year)	1995 gin_pkm_per_Mode_per_f	2000 Country[Car,Coun	2005 try]" Runs:	2010 test_policy_1	2015
Truck freight transport activity by origin country and mode % - TRA_fre_Yearly_Cogin_tom_eer_Mode_pre_Country_var		[Car,BG] [Car,CY] [Car,CZ]	24,805 3,031 49,089	27,055 3,444 58,349	31,171 4,146 67,757	35,068 4,967 71,070	41,575 5,915 72,258
GDP % - MAC_pdp_GDP_var	30	[Car,EE] [Car,HU] [Car,LV] [Car,LT]	5,411 44,979 7,922 17.025	6,067 47,984 10,020 21,396	7,366 53,405 12,508 25,092	8,509 58,215 14,228 27,092	8,953 63,753 15,248 28,809
CO2 transport emissions (tank-to-wheel) % - ENV_Yearly_CO2_emissions_var	35	[Car,MT] [Car,PL] [Car,RO]	1,376 128,016 42,032	1,558 170,502 52,331	1,715 223,215 63,442	1,868 299,875 74,627	2,122 334,493 81,340
Employment % - MAC_emp_Employment_var	33	[Car,SI] [Car,SK]	15,838	19,009	22,131 22,181	25,751 27,530	29,302
Loaded runs: Select the zones and modes Country							
CHANGE							,

You can see the key indicators at the aggregate spatial level - EU27, EU15 or EU12 - by clicking on the related button in the upper-left part of the screen.

SIST - ASsessing the Social and economic Impacts of past and future Sustainable Transport policy in Europ	8							- 0
SSIS EU27 EU15 EU12		TABLE	GRAPH	Var. from Ref. Scenario			EXPORT	PRINT
Passenger transport a provingin country Plensyear - TRA_pass_	**	Time (Year) TRA_pass	Yearly_Orig	1995 in_pkm_per_Mode_per_C	2000 ountry[Car,Cou	2005 atry]" Runs:	2010 test_policy_1	2015
k freight transport active ligin country	303	[Car,BG] [Car,CY]	early_Orign	24,805 3,031	27,055 3,444	31,171 4,146	35,068 4,967	41,575 5,915
uniter - 1947 e.C. tranil - entre Techurye Tech Connik		[Car,CZ] [Car,EE]		49,089 5,411	58,349 6,067	67,757 7,366	71,070 8,509	72,258 8,953
iano' year - MAC_gdp_Gross_Domestic_Product		[Car,LV] [Car,LT]		7,922 17.025	10,020	12,508 25.092	14,228 27,092	03,753 15,248 28,809
transport emissions (tank-to-wheel) tons/year - ENV_Tank_to_Wheel_Yearly_emissions_per_EC	46	[Car,MT] [Car,PL]		1,376 128,016	1,558 170,502	1,715 223,215	1,868 299,875	2,122 334,493
ployment Dera MAC ento Employment per EC	39	[Car,RO] [Car,SI] [Car,SK]		42,032 17,213 15,838	20,087	63,442 22,731 22,181	25,751	81,340 26,330 29,302
		1. A						
aded runs: Select the zones and modes								
4_policy_1								
Other output indicators								

For the European spatial level of analysis, the comparison between the Policy scenario and the Reference scenario is presented in a different way. When you click the **Var. from Ref. Scenario** button a different page is opened where for each Key indicator two graphs show the trend in absolute terms and the trend of the percentage variation with respect to the Reference scenario. In addition, two radar graphs summarize the values of the five indicators in the years 2030 and 2050.



The ASTRA-EC utility needs some seconds to drawn the radar graphs. A message will be issued when the graphs are ready asking, if no radar graphs are already shown, to click the **Refresh** button.



2.3 View the indicators by domain

This section provides an example based on one transport indicator; the procedure is the same for the other indicators also in the other domains.

To look at the transport results click the **Transport** button.



The values for the first transport indicator in the list is shown at the country level, in tabular format. As for the key indicators you can choose to look at results in graphical form, switch to spatially aggregated results, select only some combinations, etc.

ASSIST - ASsessing the Social and en	conomic Impacts of past and future Sustainable Transport pol	cy in Europe						- 0 -
🧱 📖 /	OUTPUT / TRANSPORT INDICATORS - (OUNTRY (1/3)						
Select th	e spatial level for the list of indicators							
13515 EU27	EU15 EU12 NUTS II		TABLE GRAPH				EXPORT	PRINT
assenger transport activity by tio Piemiyear - TRA_pass_Yearty_C	origin country and mode	25	Time (Year)	1995 in_pkm_per_Mode_per_	2000 Country[PassMod	2005 e,Country]* Runs:	2010 test_policy_1	2015
			[Car.AT]	61,870	66,943	72,586	74,602	76,731
reight transport activity by ori	gin country and mode	>>	[Car,BE]	95,251	102,781	110,398	110,175	114,957
o moyear - mor_ne_reany_or	hilmulhe_urnelhe_comex		[Car,DK]	45,736	48,322	50,623	50,189	52,016
			[Car,ES]	238,707	291,950	340,157	356,701	360,143
assenger modal split (on pkn	1)	MAP >>	[Car,FI]	51,855	58,643	62,677	64,295	66,791
 INA_pass_E0_Passenger_woo 	al_obst_bsur_oubsi		[Car,FR]	622,150	690,407	743,038	725,441	745,018
			[Car,UK]	608,111	620,484	657,506	664,309	686,368
eight modal split (on tkm)		MAP >>	[Car,DE]	809,484	845,887	871,567	872,164	904,483
 TRA_fre_EU_Freight_Modal_Spi 	([Car,EL]	55,365	64,791	73,015	74,325	78,333
			[Car,IE]	31,044	38,683	47,374	52,737	57,716
essenger transport activity by	y mode in urban context	>>	[Car,IT]	603,788	675,574	738,698	738,668	752,282
o PionJyear - TRA_pass_Yeavly_C	Vrigin_Urban_pilm_per_Mode_per_Country		[Car,NL]	122,164	134,021	146,375	147,074	153,710
			[Car,PT]	59,745	71,092	80,498	79,686	83,420
issenger transport activity by	v mode in inter-urban context	>>	[Car,SE]	86,695	92,551	100,157	103,608	109,993
o Picmiyear - TRA_pass_Yearly_C	hign_interUrban_pkm_per_Mode_per_Country		[Car,BG]	24,805	27,055	31,171	35,068	41,575
			[Car,CH]	73,316	78,511	83,947	88,924	95,078
ssenner modal solit (on okn) in urban context	MAP A	[Car,CY]	3,031	3,444	4,146	4,967	5,915
- TRA pass EU Passenger Mod	lal Split urban plom origin		[Car,CZ]	49,089	58,349	67,757	71,070	72,258
			[Car,EE]	5,411	6,067	7,366	8,509	8,953
and a second at a self (an a loss	Vie leter where seatest	1000 1 200 1	[Car,HU]	44,979	47,984	53,405	58,215	63,753
TRA pass Ell Passettoar Mod	 In Inter-urban context Solf Intervehan nime origin 	100	[Car,LV]	7,922	10,020	12,508	14,228	15,248
- mor_pass_co_Passenger_mod	al_obal_aneroraal_bour_ordat		[Car,LT]	17,025	21,396	25,092	27,092	28,809
			[Car,MT]	1,376	1,558	1,715	1,868	2,122
			[Car,NO]	46,158	52,313	58,159	63,756	69,229
			[Car,PL]	128,016	170,502	223,215	299,875	334,493
			[Car,RO]	42,032	52,331	63,442	74,627	81,340
	NEXT Transport indicators		[Car,SI]	17,213	20,087	22,731	25,751	26,330
	Select the rones and modes	10	[Car,SK]	15,838	19,009	22,181	27,530	29,302
Loaded runs:	Control and a control and modes		[Car,LU]	4,238	5,043	5,689	6,042	6,543
test policy 1	country		[Bus,AT]	8,803	8,566	8,947	9,085	9,855
	Passenger Mode		[Bus,BE]	11,892	12,050	13,915	14,647	16,745
	Freight Mode		[Bus,DK]	4,883	5,215	5,517	5,497	6,079
	Other output indicators		[Bus,ES]	41,839	43,870	48,980	53,928	60,120
	outer output moleators		[post.1]	8,441	1,123	1,000	1,511	0,091
CHANGE	KEY ECO	FIN SOC	10					

While for the key indicators the only subscript available is "country", when you look at the other indicators, there may be different segmentations available, such as passenger modes, freight modes and distance band. The procedure to select only some combinations of these elements is the same as for selecting some countries (see above). For instance, you can click the **Passenger mode** button.



The subscript PassMode consists of five elements: Car, Bus, Train, Air and Slow. If, for instance, you are interested in displaying only cars results click **None** to unselect all elements, then select Car by clicking on it and then click **Close**.



In each domain there are more pages of indicators. For instance, the indicators of the transport domain at the country spatial level are divided in three screens. Explore the other indicators by clicking the **Next transport indicators** button.

2.3.1 View the outcomes on a map

Some indicators can be analysed through a geographical depiction as well. These ones present a **Map** button beside the >> button that all indicators have.

To explain the full functionalities available in the map mode, let's assume that two scenarios are loaded (e.g. a policy scenario and the reference scenario). If you are experiencing the use of the interface following this tutorial and you have just the policy scenario loaded, load the ASTRA_EC_Sc_Reference run through the **Change** button.

Click the **Map** button corresponding to the "Passenger modal split (on pkm)" indicator at the NUTS II level.

ASSIST - ASsessing the Social and eco	nomic Impacts of past and future Sustainable Transport pol	cy in Europe		
	DUTPUT / TRANSPORT INDICATORS - N	IUTS II		
PSSIST EU27	EU15 EU12 COUNTRY		TABLE GRAPH EXPORT	PRINT
Passenger transport activity by Mio Pikmyear - TRA_pass_Yeany_On	origin country and mode grpkm_per_Mode_per_Nuts2	35	TRA_pass_EU_Passenger_Modal_Split_pkm_originxNuts2	
Passenger modal split (on pkm) % - TRA_pass_EU_Passenger_Moda(_Split_plom_onginerNuts2	MAP >>>	100	
Passenger transport activity by Mo Picniyear - TRA_pass_Yearly_Or	mode in urban context gn_Urban_pion_per_Mode_per_Muts2	du)=	75	
Passenger transport activity by i Mic Ploniyear - TRA_pasa_Yearly_Ori	mode in inter-urban context gr_hter/htan_pkm_per_Mode_per_Muts2	39		
Passenger modal split (on pkm) % - TRA_pass_EU_Passenger_Modal	In urban context Splf_urban_okm_origin_Nuts2	MAP >>	1 50	-
Passenger modal split (on pkm) % - 7RA_pass_EU_Passenger_Modal	in Inter-urban context Splk_interurban_plom_ongin_Nuts2	MAP >>		
Passenger transport volumes by Mo Pass/year - TRA_pass_Trips_Org	vorigin country and mode	>>	25	
Passenger transport volumes by Mo Passiyear - 7RA_pass_Yearly_Or	rmode in urban context gan_Urban_mps_Nuts2xMode	>>	0	
Passenger transport volumes by Mio Passiyear - TRA_pass_Yearly_Or	r mode in inter-urban context igin_interUrban_trips_per_Mode_per_Nuts2		1995 2000 2005 2010 2015 2020 2025 2030 2035 2040 2045 Time (Year)	2050
			TeA, pars [20] Parsening Model (spin), monocontrol [Constant], SerFLA [20] Sc. Reference TeA, pars [20] Parsening Model (spin), monocontrol [Constant], ASTEA [20] Sc. Reference TeA, pars [20] Parsening Model (spin), monocontrol [Constant], asTEA [20] Sc. Reference	
Loaded runs:	Select the zones and modes		TRA pars [20] Passing Modii [pin jan; enjan/httl[CaAT11] tett_policy.] TRA pars [20] Passing Modii [pin jan; enjan/httl[CaAT12] ATRA [20] E. Reference TRA pars [20] Passing Modii [pin jan; enjan/httl[CaAT12] [pin] pin [pin] TRA pars [20] Passing Modii [pin jan; enjan/httl[CaAT12] [pin] pin [pin] TRA pars [20] Passing Modii [pin jan; enjan/httl[CaAT12] [pin] pin [pin] TRA pars [20] Passing Modii [pin jan; enjan/httl[CaAT12] [pin] pin [pin] TRA pars [20] Passing Modii [pin jan; enjan/httl[CaAT12] [pin] pin [pin] TRA pars [20] Passing Modii [pin jan; enjan/httl[CaAT12] [pin] pin [pin] TRA pars [20] Passing Modii [pin jan; enjan/httl][pin [pin] pin [pin] TRA pars [20] Passing Modii [pin jan; enjan/httl][pin] pin [pin] TRA pars [20] Passing Modii [pin jan; enjan/httl][pin] pin [pin] TRA pars [20] Passing Modii [pin jan; enjan/httl][pin] pin [pin] TRA pars [20] Passing Modii [pin jan; enjan/httl][pin] TRA pars [20] Passin	
test_policy_1 ASTRA_EC_Sc_Reference	Passenger Mode		16. Juni program program program program regression (ACC) and RA (ECC) (Reference TRA parts (EV Presenter) Accel data (sing program) (North Clar ACC) in the parts (F TRA parts (EV Presenter) Accel data (sing program) (North Clar ACC) in the parts (F TRA parts (EV Presenter) Accel data (sing program) (North Clar ACC) in the parts (F TRA parts (EV Presenter) Accel data (sing program) (North Clar ACC) in the parts (F TRA parts (EV Presenter) Accel data (sing program) (North Clar ACC) in the parts (F TRA parts (EV Presenter) Accel data (sing program) (North Clar ACC) in the parts (S) (North Clar ACC) (North Clar	
	Other output indicators		TRA_pain_RU_Painings_Modal_pplit_phm_engineNant2(CarATH): ANTRA_RC_St_Reference TRA_pain_RU_Painings_Modal_pplit_phm_engineNant2(CarATH): ent_polex_1 TRA_pain_RU_Painings_Modal_pplit_phm_engineNant2(CarATH): ANTRA_RC_St_Reference	_
CHANGE	KEY ECO	ENV SOC	TRA_pars_EU_Parsenger_Modul_Split_plan_origintNats2[Car,AT33]: test_policy_1 TRA_pars_EU_Parsenger_Modul_Split_plan_origintNats2[Car,AT33]: ASTRA_EC_Sc_Reference	

A new window will be opened, showing a choropleth map relative to the selected variable. Since each variable is available for several subscripts combination, the map refers to one combination at a time. When the window is opened the map will refer to the first subscript combination (for instance, considering the indicator "Passenger modal split (on pkm)", the first map displayed will refer to mode "Air", which is the first one in the mode list).

Of course, the map shows values for a given point in time and when it is first opened the point in time is the initial year 1995.

The first time the map is drawn, zones/countries are classified into 5 groups automatically defined by the system. These groups are defined taking into account the values of the variable for the first subscripts combination, so they could not be fully representative for another subscripts combination displayed. You can however adjust the intervals. Click the **Change** link under the legend to open the configuration dialog for the thematism.



Choose for instance the quantile method to suggest new intervals. This time they will be based on the distribution of values for the actual combination of subscripts displayed.





However you can directly type the values for new intervals. You can also change the number of intervals by clicking on the drop down menu "Number of ranges".

Once you have changed settings according to your preferences, click **OK** to save the new settings and update the map according to the new classification.

You can switch to another combination of subscripts (i.e. to a different mode in the example) using the drop down menu in the upper side of the screen.



You can look at the values of the variable for the other years of the simulation by typing in the box or dragging the next slider to the preferred year. Otherwise, click the **play** button to start the animation: the map will be redrawn every time step.



Click on a zone to analyse its trend in the simulation period. A bar graph will be shown in the lower side of the window. The current year is highlighted with the corresponding bar in yellow and the value of the variable printed at its bottom. Click outside the analysed zones (i.e. in the sea or in the grey zone) to unselect the zone and close the bar graph.



During the animation the highlighted bar and its value are updated as the map. You can change the year of visualization clicking on a bar as well.

An alternative method for the selection of a zone is through the list of the zones. Click the "Select zone" link below the legend: a table listing the mapped zones will be shown. Double-click on a row to select the corresponding zone. If you do not want to select any zone, click the "Select zone" link again to close the table.



In order to navigate the map, you have to deactivate the zone selection first by clicking the hand icon of the navigation panel in the upper left side of the map (the hand icon will become coloured in red). Then click on any point of the map and drag it with the mouse, keeping clicked. Use the mouse wheel to zoom in and out. The navigation panel provides buttons (with arrows and lens) as alternative method. Click again the hand icon to activate the zone selection (the hand icon will return coloured in white).



Click the "Compare" tab above the map to show the representation of the comparison between the first two runs. The choropleth map will be based on a new classification, that takes into account the percentage difference of the first run in respect with the second one.



Click on the **save as image** button (the one with the floppy disk icon in the upper right side of the window) to export the map as image. A save-file dialog will ask you for the name and the location of the output file. If the bar graph and the legend are shown, they will be integrated in the image.

ASTRA-EC model interface - Map utility	Comparison between test_policy_1	and ASTRA_EC_Sc_Reference	_ 0 ×
test_policy_1 ASTRA_EC_Sc_Reference Com	pare		~/7
	and the second s		10
e e	Save the map		£ 2
A	Coo + Lavoro + WP4 + ASTRA-EC interface + ASTRA-EC_test +	++ Cerco ASTRA-EC, test	
	Organizza • Nuova cartella	5 · 0	
Lenend	Lavoro Nome	Ultima modifica Tipo	
3	L Note tecniche	04/11/2013 18:30 Cartella di Nie	
-64.65 - 0.99	A. Rapporti		
0.99 - 10.14	WP2		
10.14 - 19.62	1. WP3		
19.62 - 163.72	👗 WP4		
Select zone	ASTRA-EC interface		
	Lold_		
	ASTRA-EC_test		
	Man - 7		
	Nome file: Suomi_2020_compare		
	Saiva come: (images (*.png)		
The	In Nascondi cartelle	Salva Annulia	
Detail for Suomi / Finland - Ita-Suomi		and the second se	
			_
0.00			1 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4
	year 2020		

You can hide the legend and/or the bar graph by clicking respectively the 💼 and the **button** in the upper right side of the window.

Click on the **save as shapefile** button (the one with the text "SHP", in the upper right side of the window) to export the map as shapefile. A save-file dialog will ask you for the name and the location of the output file.



2.3.2 Export the data

You may want to use the results displayed in an external application. For instance, you may want to include a chart in report or you want to load data in a worksheet to use it for further calculations. To export the click the **Export** button. If you are displaying graph it will be copied to clipboard as image. If you are displaying a table it will be copied to clipboard as image.



A dialog window will inform you that the content is ready to be pasted in another document (e.g. in a MS Word document in case of a graph or in a MS Excel worksheet in case of a table).



To directly print the output (the graph or the table, according to what is shown), click the **Print** button.

ASSIST - ASsessing the Social and economic Impacts of pait and future Sustainable Transport pol	icy in Europe	
	NUTS II	
Select the spatial level for the list of indicators EU27 EU15 EU12 COUNTRY		TABLE GRAPH EXPORT PRINT
Passenger transport activity by origin country and mode Mo Piemyear - TRA_pass, Yeary, Onget_piem_per_Mode_per_Nuts2	35	TRA_pass_Yearly_Origin_pkm_per_Mode_per_Nuts2
Passenger modal split (on pkm) 6 - TRA_pass_EU_Passenger_Micdal_Split_pkm_orginurMuts2	MAP >>	200,000
Passenger transport activity by mode in urban context dio Ploniyear - TRA_pass_Yearty_Orgin_Lititian_plom_per_Mode_per_Muts2		150,000
Passenger transport activity by mode in inter-urban context dro Ploniyear - TRA_pass_Yeany_Orgm_Inter/Inban_plim_per_Mode_per_Nats2	>>	
Passenger modal spilt (on pkm) in urban context 6 - TRA_pass_EU_Passenger_Modal_Spilt_urban_pkm_origin_Muts2	MAP >>>	100,000
Passenger modal split (on pkm) in Inter-urban context % - TRA_pass_EU_Passenger_Modal_Split_interurban_pkm_ongin_Muts2	MAP >>	· ·
Passenger transport volumes by origin country and mode the Passiyear - TRA_pass_Trips_Orgin_per_ModexNuts2	**	50,000
Passenger transport volumes by mode in urban context <i>ito Pasaryear - TRA_pasa_Vearly_Cinger_Litban_tips_Natis2xMode</i>	>>	
Passenger transport volumes by mode in inter-urban context Mo Passiyeer - 7704_pass_Yearly_Origin_InterUntum_trips_per_Mode_per_Nuts2		1995 2000 2005 2010 2015 2020 2025 2030 2035 2040 2045 2050 Time (Year)
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Select a printer in the dialog box and click **OK**.

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2.4 Export all indicators

In case you want to save the whole set of results (e.g. to make them available for future analysis) click the **Export all indicators** button.



A file-save dialog will ask you to select the .<u>vdf</u> file (output of a scenario) you want to export all indicators from, specify the name of the output file and where to save it. Type the name you want (e.g. "exported") and click **Save**. The "exported.tab" file will be created in tab separated format. The indicators will be listed sequentially in the file.

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Open the "exported.tab" file with a text editor or Excel to look at its content.

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254 TRA pass_St	have tolled Motorway_NATIGET ST		0.029	0.053	0.057	0.056	0.063	0.042	0.045	0.044	0.0443	0.071	0.0715	0.040						
255 TRA pass Sr	tare_toiled_Motorway_NAT[GR1,ST]		0.045	0.001	0.057	0.00	0.003	0.000	0.0075	0.009	0.07	0.071	0.0715	0.072						
250 TRA pass_SI	have telled Meterowy NATION ST		0.008	0.009	0.01	0.053	0.0115	0.012	0.0123	0.061	0.015	0.013	0.015	0.013						
257 TRA_pass_St	have tolled Motorway_NAT[CR4.51]		0.04	0.043	0.03	0.033	0,0555	0.038	0.0393	0.001	0.0013	0.002	0.0023	0.003						
350 TRA part Sh	have tolled Motorway NATIES1 STI		0.005	0.006	0.007	0.007	0.0075	0.002	0.009	0.002	0.008	0.002	0.0095	0.000						
MO TRA pass Sh	have tolled Motonum NATIES2 ST		0.003	0.000	0.007	0.016	0.0073	0.008	0.000	0.000	0.000	0.000	0.0105	0.003						
261 TRA pass_Sh	hare tolled Motorway NATIES2 ST		0.008	0.014	0.012	0.013	0.0135	0.014	0.0165	0.015	0.0155	0.015	0.0195	0.016						
262 TRA pass Sh	have tolled Motorway NATIESS STI		0.002	0.002	0.002	0.002	0.002	0.002	0.0025	0.003	0.003	0.003	0.003	0.003						
262 TRA pass Sh	have tolled Motorway NATIESS STI		0.002	0.002	0.001	0.013	0.0135	0.014	0.0023	0.003	0.0145	0.015	0.005	0.015						
264 TRA pass Sh	have tolled Motorway NATIESS STI		0.005	0.006	0.007	0.007	0.0075	0.008	0.008	0.0024	0.0045	0.000	0.000	0.000						
265 TRA pass St	hare tolled Motorway NATIER1 ST		0.004	0.005	0.005	0.005	0.005	0.005	0.0055	0.006	0.006	0.006	0.005	0.005						
266 TRA mass Sh	have tolled Motorway NATIFR2 STI		0.035	0.039	0.044	0.046	0.0485	0.051	0.052	0.053	0.054	0.055	0.055	0.055						
267 TRA pass Sh	hare toiled Motorway NATIFR3.5TI		0.04	0.045	0.051	0.053	0.056	0.059	0.06	0.061	0.062	0.063	0.0635	0.064						
268 TRA pass Sh	hare toiled Motorway NATIFR4.STI		0.042	0.047	0.053	0.055	0.058	0.061	0.0625	0.064	0.0645	0.065	0.066	0.067						
269 TRA pass Sh	hare toiled Motorway NATIFRS STI		0.035	0.04	0.045	0.047	0.0495	0.052	0.053	0.054	0.055	0.056	0.0565	0.057						
270 TRA pass Sh	hare tolled Motorway NATIFR6.STI		0.045	0.051	0.057	0.06	0.063	0.066	0.0675	0.069	0.07	0.071	0.0715	0.072						
271 TRA pass Sh	hare toiled Motorway NATIFR7.5TI		0.024	0.027	0.03	0.032	0.0335	0.035	0.0355	0.036	0.0365	0.037	0.0375	0.038						
272 TRA pass Sh	hare tolled Motorway NATIFR8.STI		0.044	0.05	0.056	0.059	0.062	0.065	0.0665	0.068	0.069	0.07	0.0705	0.071						
273 TRA pass Sh	hare tolled Motorway NAT[ITC.ST]		0.032	0.036	0.04	0.043	0.045	0.047	0.048	0.049	0.0495	0.05	0.0505	0.051						
274 TRA pass Sh	hare tolled Motorway NAT[ITD,ST]		0.032	0.036	0.04	0.043	0.045	0.047	0.048	0.049	0.0495	0.05	0.0505	0.051						
275 TRA pass Sh	hare tolled Motorway NAT[ITE,ST]		0.029	0.033	0.036	0.038	0.04	0.042	0.043	0.044	0.0445	0.045	0.0455	0.046						
276 TRA pass Sh	hare tolled Motorway NAT[ITF,ST]		0.008	0.009	0.01	0.011	0.0115	0.012	0.012	0.012	0.0125	0.013	0.013	0.013						
277 TRA pass Sh	hare tolled Motorway NAT[ITG.ST]		0.016	0.018	0.02	0.021	0.022	0.023	0.0235	0.024	0.0245	0.025	0.0255	0.026						
278 TRA pass Sh	hare tolled Motorway NAT[CY0.5T]		0	0	0	0	0	0	0	0	0	0	0	0						
279 TRA pass Sh	hare tolled Motorway NAT[LV0,ST]		0	0	0	0	0	0	0	0	0	0	0	0						
280 TRA pass Sh	hare tolled Motorway NAT[LT0,ST]		0	0	0	0	0	0	0	0	0	0	0	0						
281 TRA_pass_Sh	hare_tolled_Motorway_NAT[LU0,ST]		0	0	0	0	0	0	0	0	0	0	0	0						
282 TRA_pass_Sh	hare_tolled_Motorway_NAT[HU1,5T]		0.015	0.017	0.019	0.02	0.021	0.022	0.0225	0.023	0.0235	0.024	0.024	0.024						
283 TRA_pass_Sh	hare_tolled_Motorway_NAT[HU2,ST]		0.015	0.017	0.019	0.02	0.021	0.022	0.0225	0.023	0.0235	0.024	0.024	0.024						
284 TRA pass Sh	hare toiled Motorway NATIHU3.STI		0.015	0.017	0.019	0.02	0.021	0.022	0.0225	0.023	0.0235	0.024	0.024	0.024						+11
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