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HIGH-TOOL User Guide

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Glossary

CH	Switzerland
CO₂	Carbon dioxide
DG MOVE	European Commission's Directorate-General for Mobility & Transport
EC	European Commission
ETISplus	European Transport Policy Information System
EU	European Union
EU28	28 Member States of the European Union
Eurostat	Statistical Office of the European Union
EXIOBASE	A global, detailed Multi-Regional Environmentally Extended Supply and Use/Input-Output Database
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GVA	Gross value added
NO	Norway
NO_x	Nitrogen oxides
NUTS	Nomenclature of Territorial Units for Statistics; A number assigned to define the level of granularity, such as 0 for the country level.
O/D	Origin/destination; used to describe a relation between two regions.
OECD	Organisation for Economic Co-operation and Development
P/A	Production/Attraction; used to describe a relation between two regions.
pkm	Passenger-kilometre
PM	Particulate matter
SO₂	Sulphur dioxide
SUMMA	Sustainable Mobility, Policy Measures and Assessment
tkm	Tonne-kilometre
TRANS-TOOLS	Network-based European Transport Model
vkm	Vehicle-kilometre
WP	Work package

Preface

This User Guide has been prepared for the HIGH-TOOL model for strategic assessment of economic, social and environmental impacts of transport policy measures. HIGH-TOOL is an open source model developed under the project of the same name and co-funded under the Seventh Framework Programme, in the period 2013 to 2016. This User Guide supports users, who are mainly policy makers and analysts in creating and running simulations of transport policies and specific policy issues. More detailed information on the model structure, methodology, and other aspects of model development can be obtained from the various HIGH-TOOL project deliverables that are available at high-tool.eu. An overview of these deliverables is presented below.

Deliverable	Contents
HIGH-TOOL Final Report	Overview of all HIGH-TOOL aspects
Final Structure of the HIGH-TOOL Model	Model structure and transport policy measures considered
Documentation: Updated Input Database for the HIGH-TOOL Model	All aspects related to data and the developed database
Elasticities and Equations in the HIGH-TOOL Model (Final Version)	Methodology underlying the computations
Final Version of the HIGH-TOOL Model: Documentation	Documentation of the model, including operational aspects
Design Criteria for the User Interface and Policy Assessment Reports (Final Version)	User interface and reporting of assessment results

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Project Homepage

www.high-tool.eu

2 Introduction

2.1 Overview

Purpose

HIGH-TOOL is an open source, high-level strategic assessment model for use by EU policy makers and policy analysts to assess economic, social and environmental impacts of transport policy measures. The model has two purposes. It can be applied for strategic assessment of transport policy options, and to support identification of policy options for further analyses using more detailed assessment instruments.

Overall Structure

The HIGH-TOOL model comprises three key elements:

- Core modules that are the modelling framework
- Data Stock to facilitate data exchange
- User Interface for the model and to access the assessment results.

The overall structure of the HIGH-TOOL model is presented in Figure 1.

Core Modules

The HIGH-TOOL model comprises seven modules as follows:

- Demography (DEM)
- Economy & Resources (ECR)
- Passenger Demand (PAD)
- Freight Demand (FRD)
- Vehicle Stock (VES)
- Environment (ENV)
- Safety (SAF).

Data Stock

The Data Stock ensures data exchange between the modules, provides exogenous input to the modules, and stores intermediate and output data. A key data reference for HIGH-TOOL is the data collated and generated within the FP7 project ETISplus.

User Interface

The User Interface enables selection and definition of transport policies and the management of model runs, and access to the assessment results.

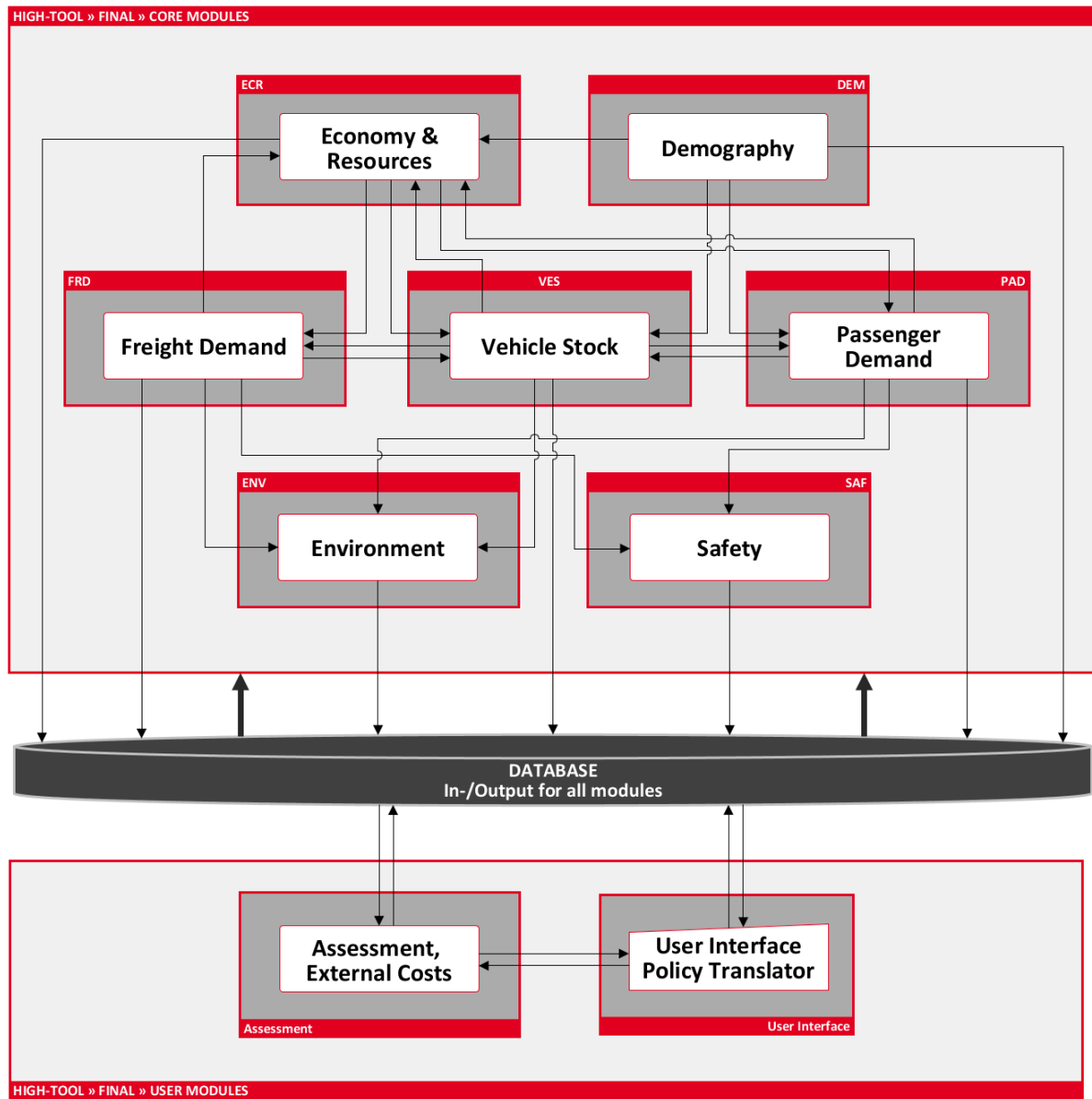


Figure 1: Overall structure of HIGH-TOOL assessment model

2.2 HIGH-TOOL Modules

The functions of each module in HIGH-TOOL model are briefly outlined. Further methodological details are presented in the [project report on elasticities and equations](#).

Demography module

The Demography module (DEM) estimates the projected regional population and labour force in the 28 EU Member States and in Norway and Switzerland. UN projections are provided for other countries worldwide and are adapted to the geographic zoning system used in HIGH-TOOL.

The population and labour force are calculated by country for the EU 28, Norway and Switzerland based on EU Reference Scenario assumptions on fertility rates, life expectancies at birth and net migration (European Commission, 2013). The projected population values are then disaggregated to geographic zones based on historical demographic trends. The net migration distribution per zone is based on socio-economic data, specifically historical data on income and employment. Population development at country level is simulated with a cohort component that incorporates the effects of demographic drivers and migration.

Regional disaggregation of the population excluding migration is based on the 2010 historical regional distribution. Net migration is then regionally distributed using a distribution proxy based on income and employment rate. Labour force is estimated from the labour force percentage defined in the EU Reference Scenario and underlying assumptions.

The structure of the Demography (DEM) module is presented in Figure 2.

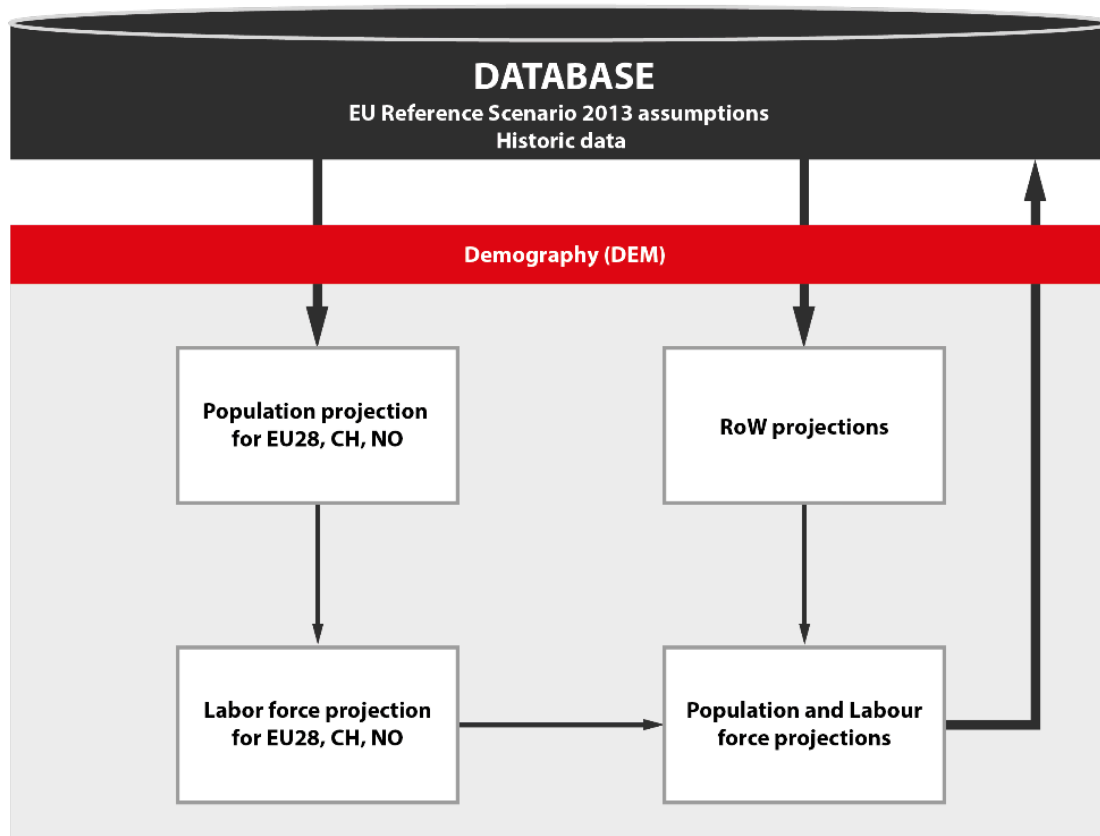


Figure 2: Structure of the Demography (DEM) module

Economy & Resources module

The Economy & Resources module (ECR) comprises three components: Economy, Resources, and the combined component of GDP, Trade, Energy, Resources, and Production/Distribution.

The Economy sub-module estimates total output, capital stock and labour use in the economy, for which the general drivers (GDP, household income per capita, and population) are exogenously defined by the EU Reference Scenario 2013. These drivers are disaggregated from country to zone based on ETISplus data (regional GDP, regional population, and labour force). The combined component (GDP, Trade, Energy, Resources, Production/Distribution) estimates and projects employment, trade, resource consumption, and purchasing power under various transport policy measures. The Resources component calculates environmental indicators (without combustion) using the EXIOBASE database for CO₂, NO_x, SO_x, PM, biomass, fossil fuel use, metal use, mineral use, wood use, and water use.

The structure of the Economy & Resources (ECR) module is presented in Figure 3.

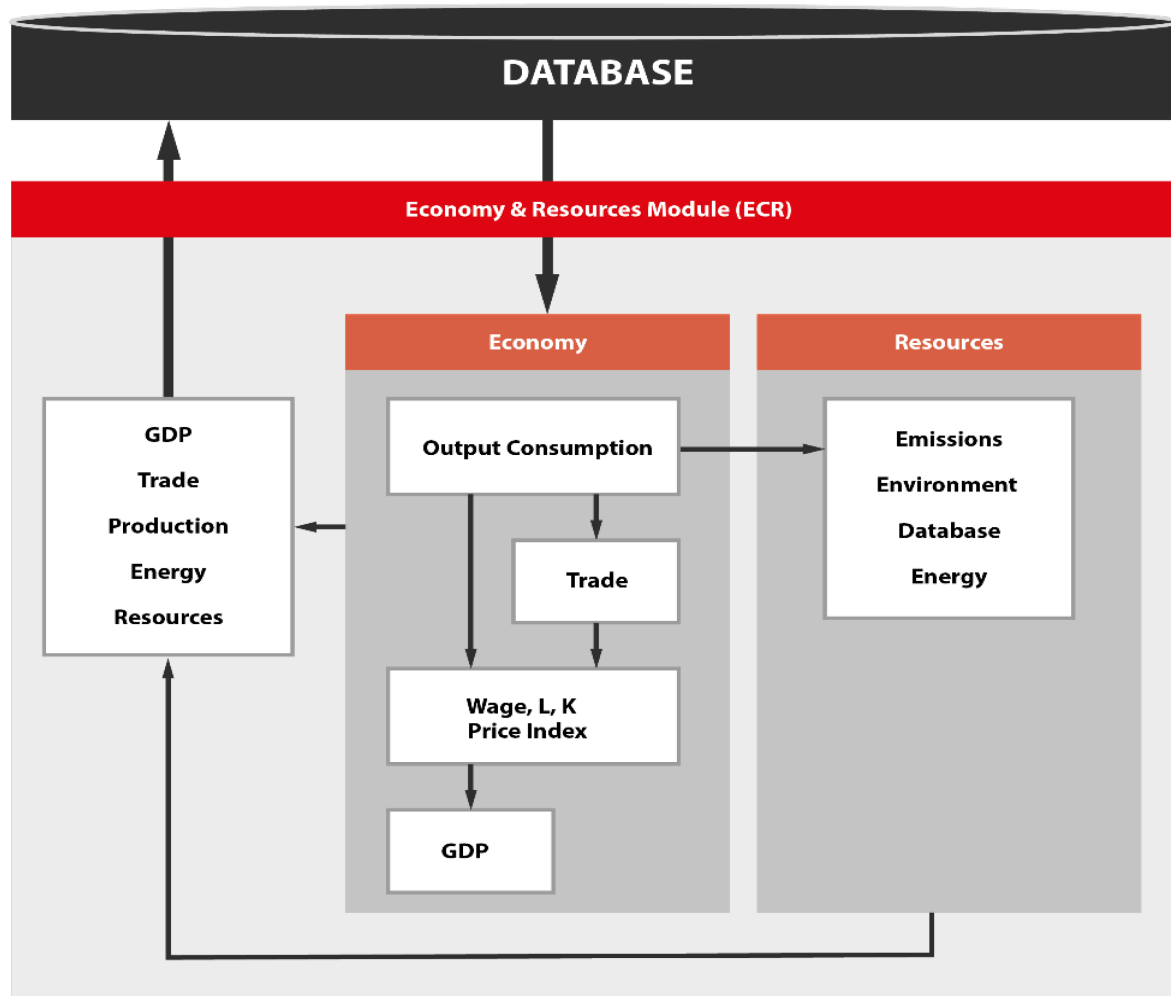


Figure 3: Structure of the Economy & Resources (ECR) module

To generate economic output and environmental data, this module uses regional demographic and labour data provided by the Demography (DEM) module, transport costs by the Freight Demand (FRD) module, the type of vehicles purchased by the Vehicle Stock (VES) module, and passenger demand by the PAS module. The economic and environmental indicators generated are used in the other modules.

Economic indicators are a key driver of passenger and freight demand, and demand for vehicle stock. Hence, there is feedback between these modules. The ECR module generates updated employment and income data used in the DEM module to ensure consistency of population distribution and spatial economic development.

Vehicle Stock module

The Vehicle Stock module (VES) converts passenger and freight demand to vehicle fleet size, which is disaggregated to vehicle type and vehicle age cohort for calculation of emissions and energy use. The module includes vehicle types by propulsion and fuel technologies, and incorporates 61 road and 12 non-road vehicle types. The vehicle age cohorts range from 0 to 29 years.

Fleet stock forecasts are provided by country and region for each of the 28 EU Member States and for each period (5-year intervals) up to 2050. The module also delivers forecasts of average fixed and variable generalised costs for each vehicle type, and total tax revenue per country.

The structure of the Vehicle Stock (VES) module is presented in Figure 4.

Taking into account transport demand and vehicle stock in the previous period, as well as the vehicles that survived in current period, the demand is calculated for new vehicles and the average mileage per vehicle.

The logit and the stock dynamic model in the Vehicle Stock module use the calculated average generalised costs to define the number and proportion (%) of the different types of new vehicles entering the market. This calculation produces the detailed vehicle stock in the current period.

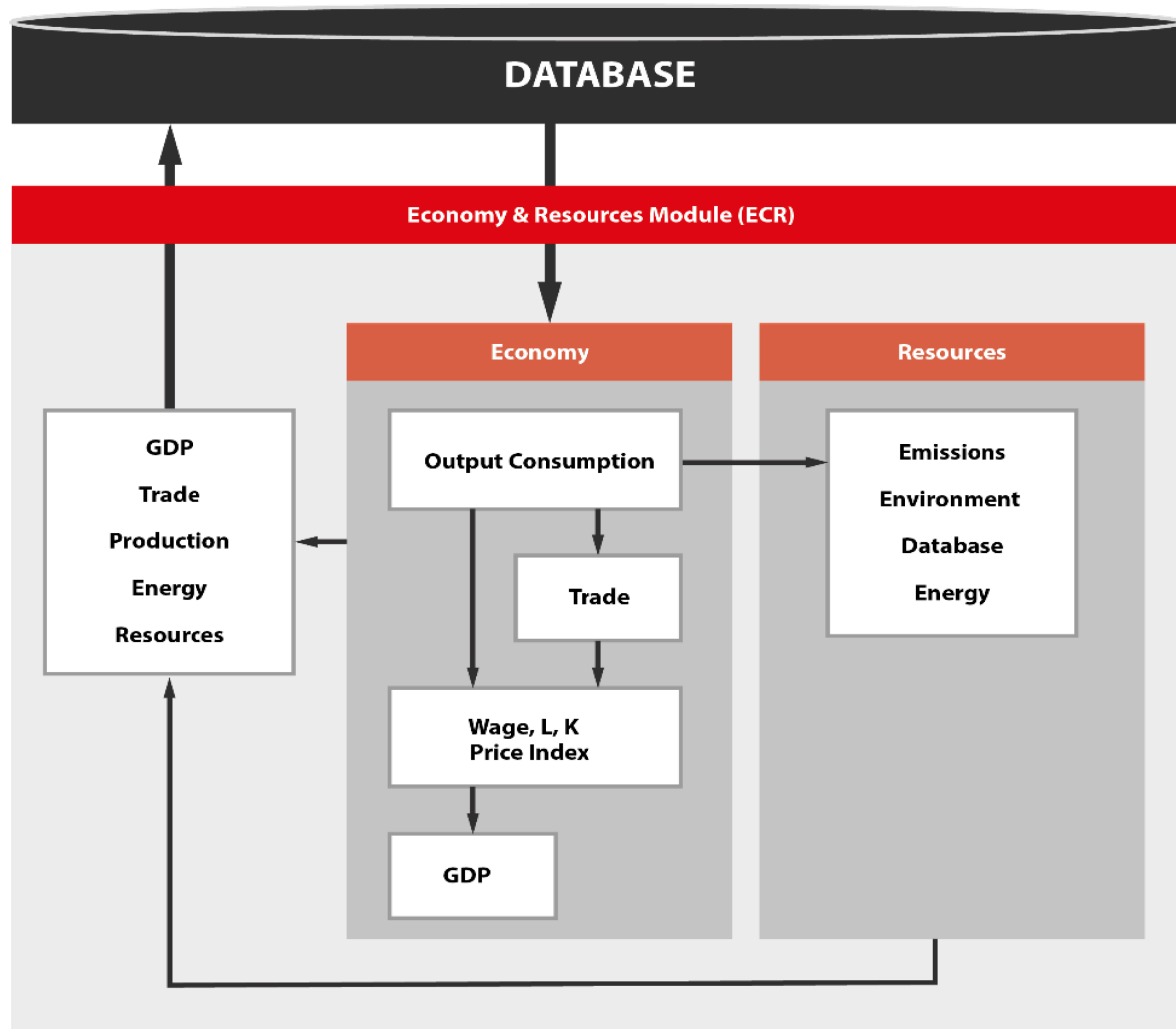


Figure 4: Structure of the Vehicle Stock (VES) module

Passenger Demand module

The Passenger Demand (PAD) module follows the classical four-step approach to transport demand modelling (Ortúzar and Willumsen, 2011) of generation, distribution, modal split and assignment with the following differences. Instead of the assignment step, the module translates number of trips into transport performance by the conversion. The generation step estimates the trip demand for each origin. In the distribution step, the origin-destination trip matrix is computed and then further divided in the modal split step into transport modes. The conversion step derives transport performance indicators, such as passenger-kilometres and vehicle-kilometres.

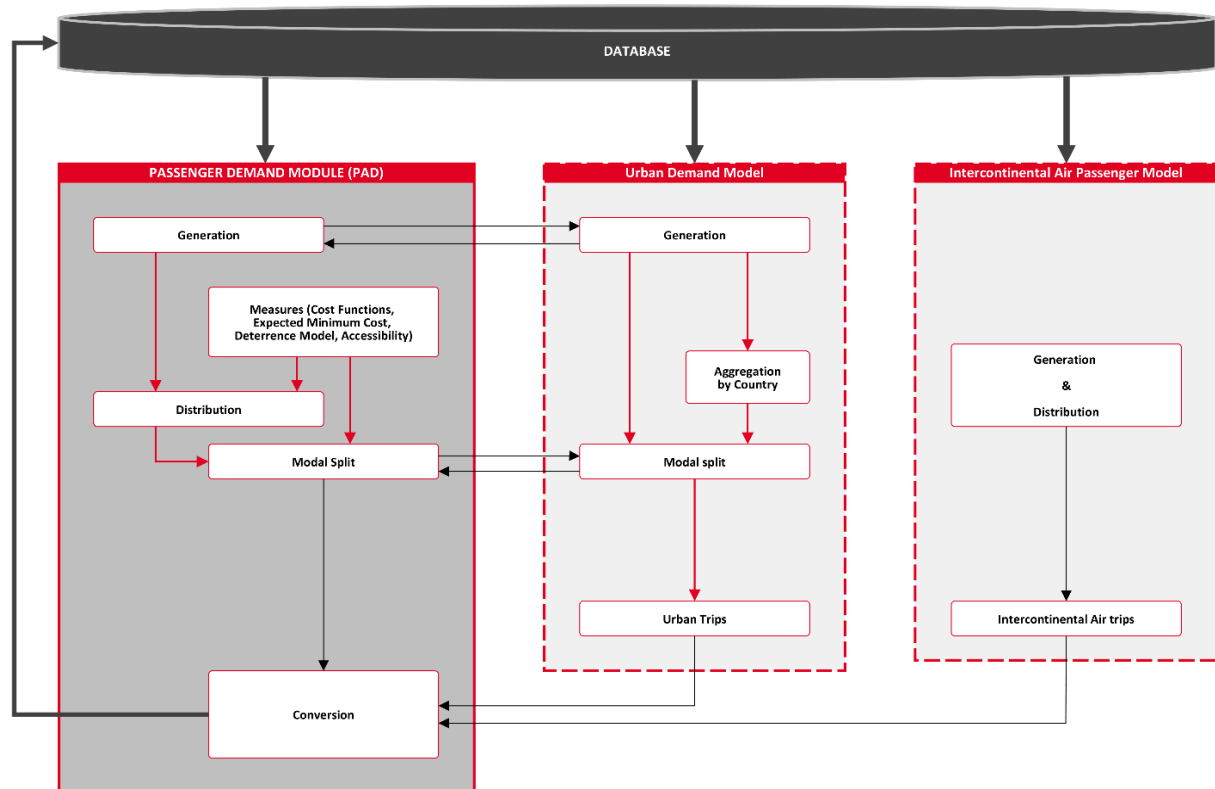


Figure 5: Structure of the Passenger Demand (PAD) module

Trip generation is carried out by a regression approach. The distribution and the model split components are integrated using the Expected Minimum Cost (EMC) measure, which relies on the Expected Maximum Utility (EMU) or logsum measure. For the cost functions, the concept of generalised time is used in which the cost unit refers to minutes and not to monetary terms. The EMC values are computed using a Nested Logit model.

Road trips are split by car and powered two-wheelers, under the assumption of country-specific shares and motorisation levels.

The core PAD module is complemented by two additional modules (see Figure 5). The first is urban passenger demand, which follows a generic, elasticity-based approach. As urban trips are a subset of intra-zonal trips, the generation step is linked to the core PAD module. The second is intercontinental air passengers, which uses a regression-based approach to estimate the number of flights between European regions and intercontinental destinations.

Freight Demand module

The Freight Demand (FRD) module consists of four components: trade conversion, route choice, modal split, and conversion. The trade conversion component converts trade values to volumes and extracts air demand from total trade between an origin and destination. The route choice and modal split components distribute demand across transport chains and perform a modal split on each leg of the transport chains, while applying the effects of measures.

The conversion component derives other transport indicators, such as tonne-kilometres and vehicle-kilometres. The transport indicators relating to full-freight aircraft are determined in a subcomponent and feed into the conversion component.

An overview of the Freight Demand (FRD) module is presented in Figure 6.

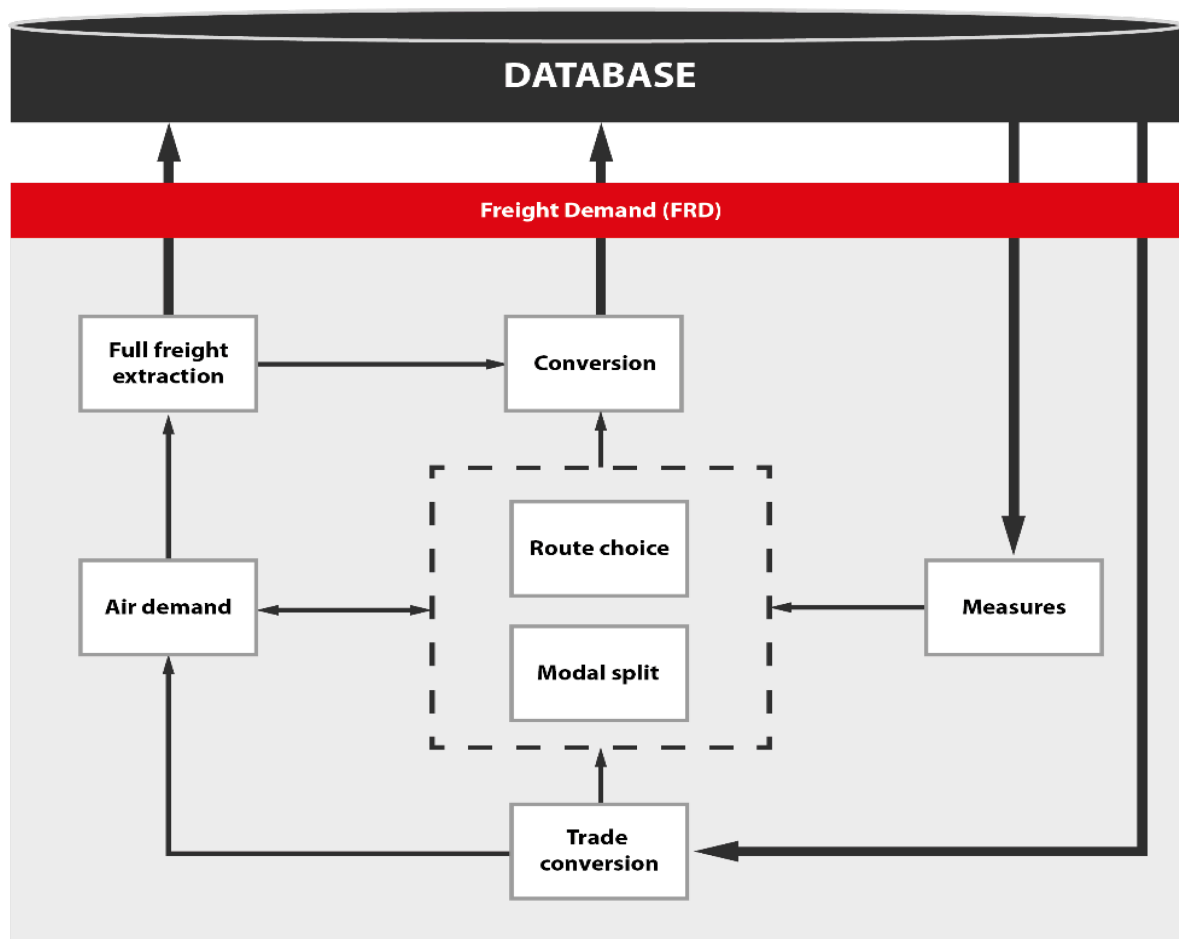


Figure 6: Structure of the Freight Demand (FRD) module

The Freight Demand module together with the Economy & Resources module follow an analogue approach to the classical four-step methodology of generation, distribution, modal-split and assignment. The latter is replaced by calculation of performance indicators in the conversion component.

The module delivers trade in value per origin-destination (O/D), which is converted to volumes by applying volume density assumptions per O/D and commodity (assumed constant over time) extracted from ETISplus database.

The air demand base matrix extracted from ETISplus is adjusted according to growth in imports and exports delivered by the ECR module, and subtracted from total trade. This results in tonnes demand per commodity per Origin-Destination.

Each origin-destination is connected by route chains that have been extracted from the ETISplus database. These chains form up to three legs that connect origin and destination via up to two transshipment regions. For each leg, the modal split is calculated taking into account cost elements that can be influenced by the Vehicle Stock module. This is done to compute generalised cost per mode connecting an origin and destination of a leg through a multinomial logit function according to TRANSTOOLS. Based on total generalised costs for route chains connecting origin and destination, demand is distributed across the route chains through transshipment regions by applying a multinomial logit.

The conversion step calculates tonne-kilometre and vehicle-kilometre performance indicators for the origin region and “on the territory” perspective. The latter is calculated by applying the share of distance in a leg in a country obtained, using data from ETISplus.

Finally, assumptions on full-freight share and capacity of airfreight transport are applied to extract airfreight transport by full-freight aircraft from the total demand for air.

Environment module

The Environment (ENV) module calculates wheel-to-tank fuel consumption and emissions for each vehicle type. The key variables in this calculation are fuel consumption or fuel intensity, and emission factors or emission index. These factors are divided into technologies that are represented in the model by the age cohort or vintage.

The module produces estimates of CO₂ emissions and five other pollutants: CO, VOC, NO_x, SO₂ and PM2.5. Fuel consumption and emissions are calculated per origin country and disaggregated to zones based on the share of transport demand in each zone.

The Environment module receives input from the Passenger and Freight Demand modules and from the Vehicle Stock module (fleet size).

The module comprises two parts (see Figure 7). Firstly, the predicted transport demand segmented by country, mode and fuel type is disaggregated by vehicle type and vehicle technology (represented by the vehicle age cohort). Secondly, fuel consumption and emissions are derived and calculated for each mode, vehicle type, fuel, and age cohort (technology) using the previously disaggregated transport demand, fuel consumption and emission factors.

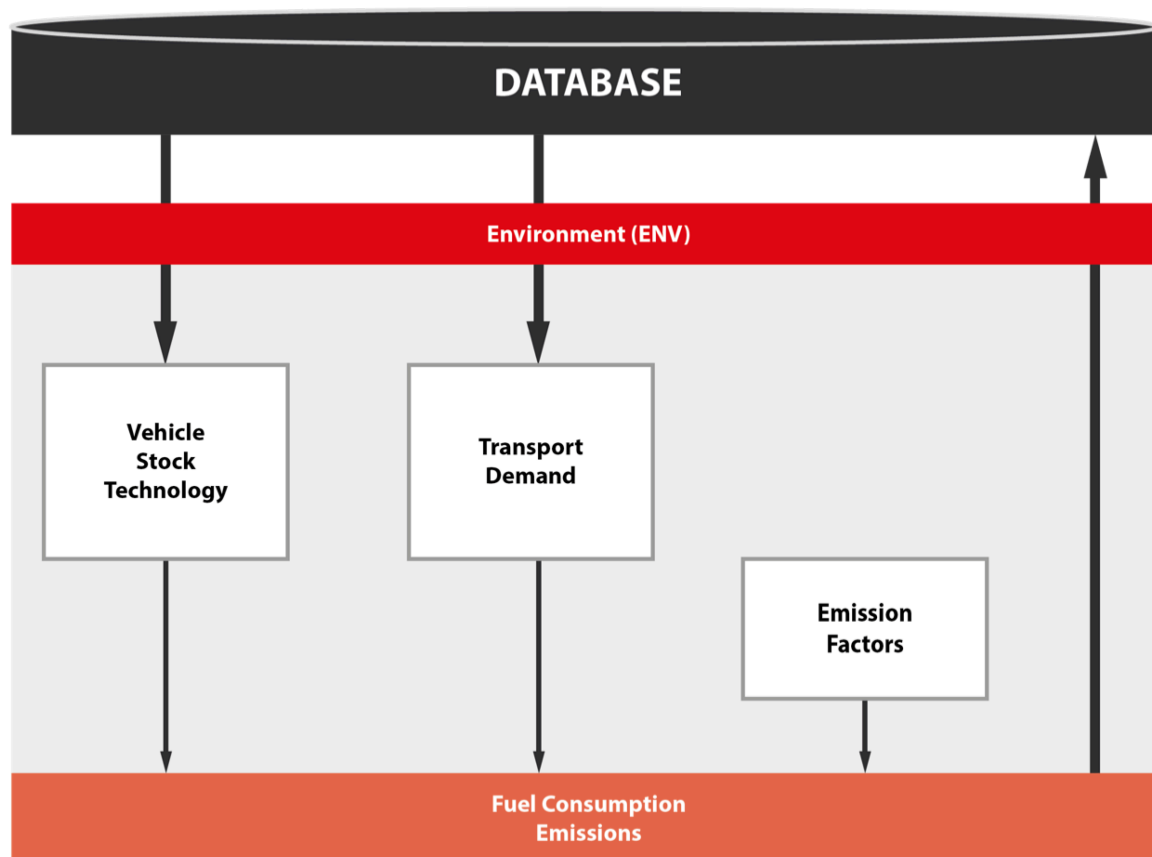


Figure 7: Structure of the Environment (ENV) module

Datasets on fuel consumption and emission factors for all vehicle age cohorts (technology) are available for the year 2010. For each period in the remaining simulation period (2015–2050), only factors of the new vehicles (vehicles between 0 and 4 years-old) are available in the dataset. These factors are modifiable to enable policy simulation, such as introduction of new emission standards in a specific time or simulation period.

Fuel consumption and emission factors of older vehicles (vehicles more than four years old) are derived from the dataset for the previous period. For example, fuel consumption factors for 5 year-old vehicles in period (t) equal the fuel consumption factors for new vehicles in period (t-5).

Safety module

The Safety module (SAF) assesses the impact of transport policy measures on safety, and yields predictions of the number of fatalities and injuries, and associated social costs.

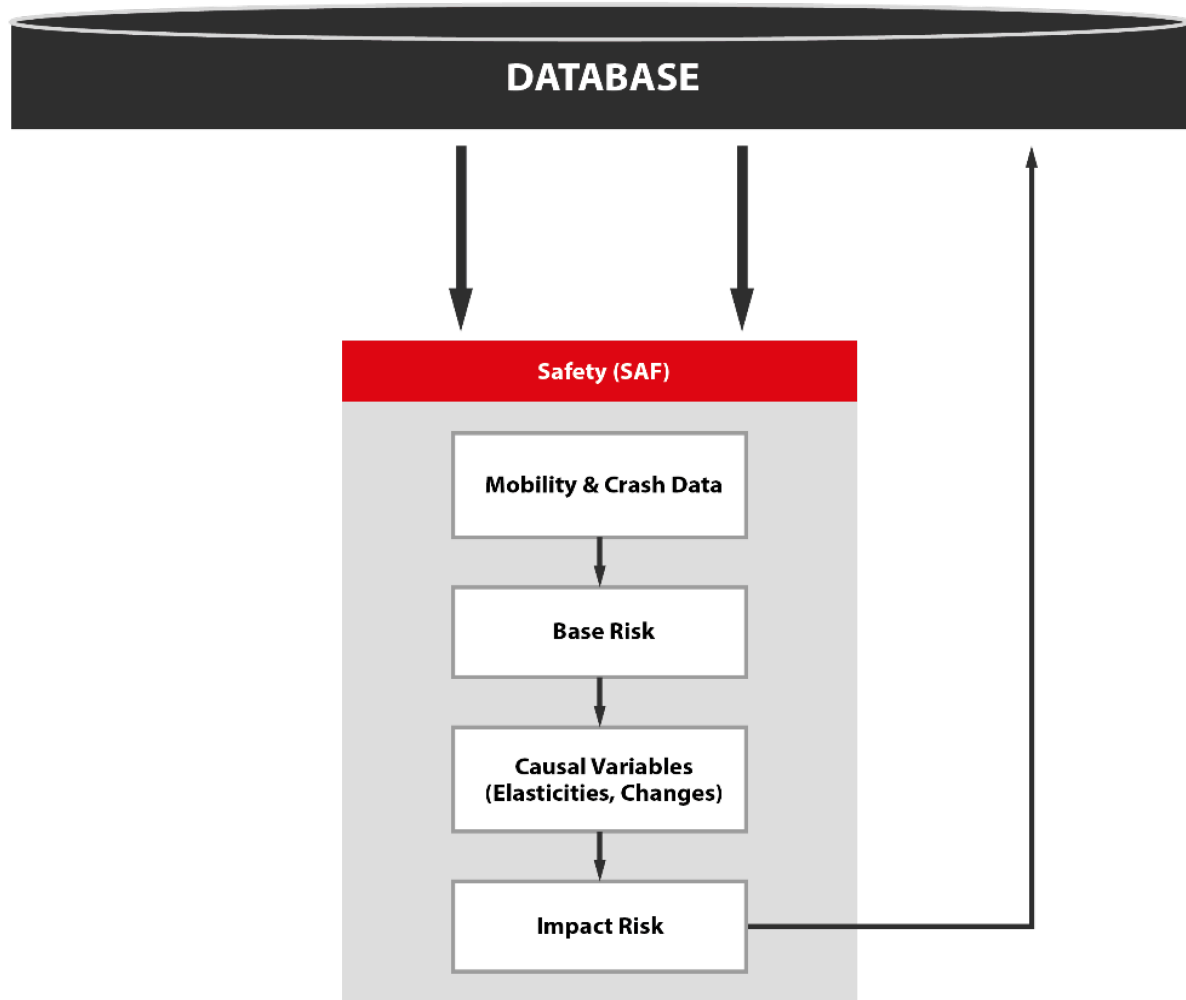


Figure 8: Structure of the Safety (SAF) module

The required inputs include historical mobility data from the Data Stock, predicted mobility (from the Passenger and Freight Demand modules), and user input changes to safety risk and safety risk causal factors. Risk is defined as the number of occurrences (fatalities, injuries) per unit of mobility (in vehicle-kilometre or trips).

The module distinguishes road and non-road modes that are dealt with at different levels of detail. Road safety is treated in the most detail and predicts fatalities as well as serious and minor injuries. Road is further split into car, truck, powered two-wheelers, public transport, bicycle, and pedestrians. Non-road modes include rail, air, short sea shipping, and inland waterways. The results are presented per country and time period.

For each transport mode, there are two components. The first is the Business-as-Usual (BAU), which calculates safety risks and makes predictions based on risk trend lines (from historical mobility and safety data) and mobility predictions (from the Passenger and Freight Demand modules). The second is the scenario component that adapts the BAU risks according to the anticipated effect of the safety measures modelled. The effect is derived from changes in accident causal factors (which are the policy inputs) and the elasticities and equations relating these to changes in risk. Safety predictions for the scenario follow from these scenario risks and mobility predictions. Road fatalities, serious and minor injuries are predicted and in the other modes, the focus is on fatalities. The social costs are calculated for all modes.

The structure of the Safety module is presented in Figure 8.

Chronological sequence

The models interact sequentially, and this reduces the number of computation loops required. The chronological sequence of a model run is as follows:

- A sequence starts with the Demography (DEM) module to produce demographic outputs for all forecast years (2015 to 2050).
- The Economic & Resources (ECR) module is run using the DEM results for a time step (t) and outputs from Vehicle Stock (VES) Passenger Demand (PAD) and Freight Demand (FRD) modules for the previous time step (t-1).
- The Vehicle Stock (VES) module is activated using outputs from DEM/ECR (step t), and PAD/FRD (step t-1).
- PAD and FRD are run using results from DEM/ECR/VES, and ECR/VES, respectively.
- The results from PAD, FRD and VES are delivered for all years to the Environment (ENV) module to compute the environmental impacts, and from PAD and FRD to Safety (SAF) to compute the safety impacts.

The base year is 2010. Thus, the first time step, 2015, is partly driven by 2010 results, and 2020 by 2015 results. The chronological sequence of a model run is shown in Figure 9.

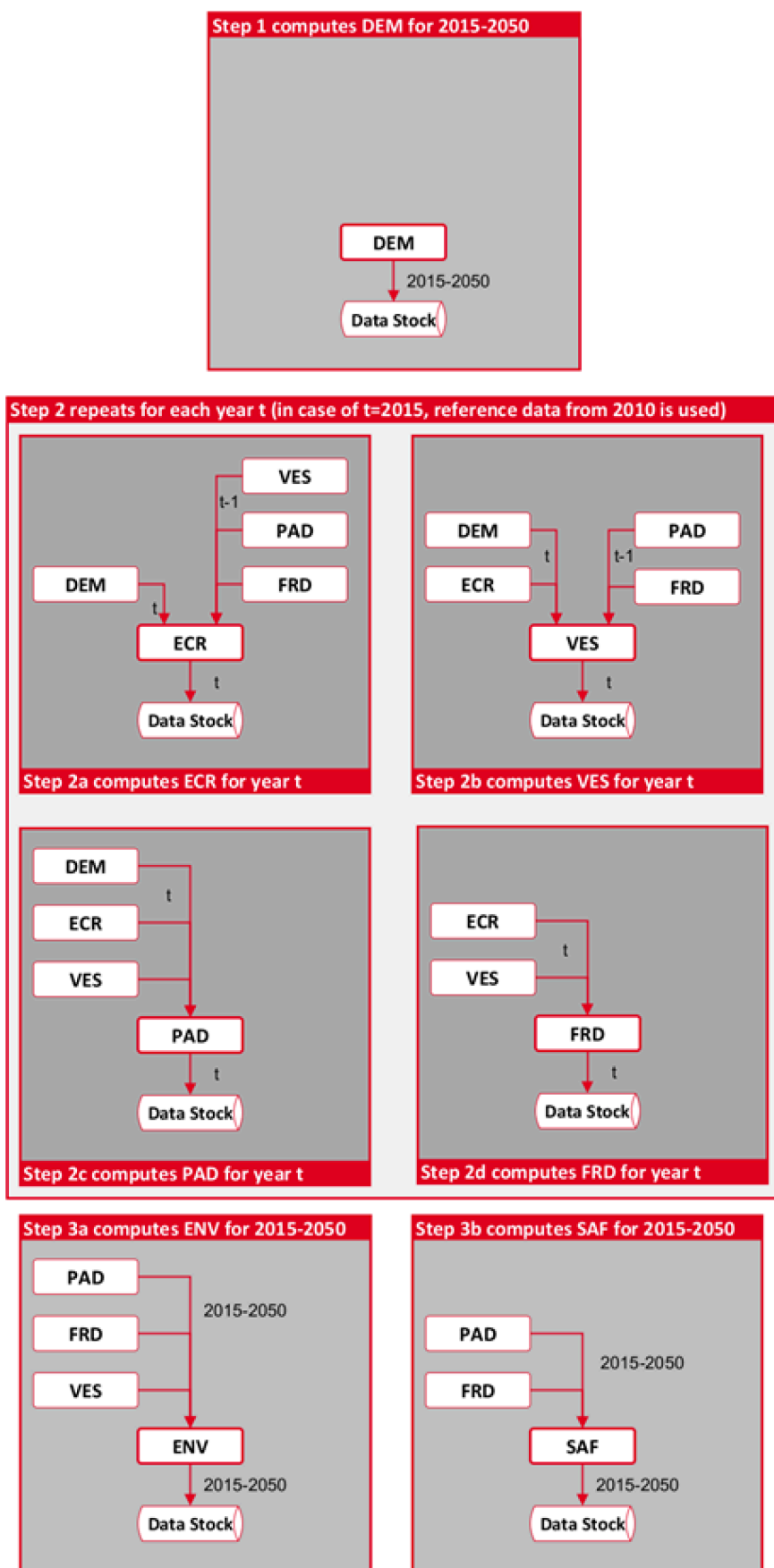


Figure 9: Chronological sequence of a model run

3 User Guidance

The key steps in carrying out a transport policy analysis in HIGH-TOOL are defining the policy assumptions, running the simulation, and obtaining outputs. This information is applicable to both the online and stand-alone versions of the HIGH-TOOL model.

3.1 Getting Started

A transport analysis can be defined in one of three ways as follows:

1. A **Single Transport Policy Measure (TPM)** can be defined and run in the Baseline Framework Conditions (EU Reference Scenario 2013). A set of predefined TPMs can be run individually on the reference socioeconomic baseline conditions. For each TPM, input variables are provided and a reasonable range of impacts. This is the simplest analysis of the impacts of transport policies.
2. A **Combined TPM package of policies** can be defined in the Baseline Framework Conditions (EU Reference Scenario 2013). This process is envisaged for more complex policy packages that integrate several TPMs.
3. A **Customised Policy package** can be defined of individual policy levers in the HIGH-TOOL modules. When a new TPM is created, all variable fields are assigned default reference values. You only need to change those parameters that differ specifically from the reference package.

All three options allow an extra optional step, known as the **Expert Mode**. In this step, you can change an individual value by downloading raw CSV tables from the **Data Stock**, or by changing the impedances using the **Hyper-network** interface.

The output of a model run is a **Policy Assessment Report** that sets out the results in a standard format. A Policy Assessment Report comprises two components:

- A set of Synthesis Indicators summarising the simulation including the policies, framework conditions selected, and results.
- A report in MS EXCEL format of all results disaggregated by geographical areas and transport modes.
- The report is automatically generated and can be downloaded from the online application of the HIGH-TOOL.

In addition, all detailed outputs in the **Data stock** are accessible through an interface that enables easy export of the full tables for presentation and processing using spreadsheet software.

3.1.1 Select a Single Transport Policy Measure (TPM)

A single TPM can be quickly and easily launched without complex input processes:

- Select the TPM to be analysed from **Policies >> Define a Single Transport Policy Measure (TPM)**.
- Modify values for TPM variables using the interface as shown for variable magnitude (Section 3.3), temporal dimension (Section 3.4), and spatial distribution (Section 3.5).
- Click **Save this TPM** and add a title and an abstract to describe the policy.
- Select and click the saved TPM in **Run >> Run a policy package**.
- To make additions before running the simulation, enter the **Expert Mode** by ticking the box at the bottom left of the dialog (see Section 3.7).

3.1.2 Select a Combined TPM Package

A combined package of predefined TPMs can be constructed by ticking the box for each TPM to be included from the list of TPMs presented. The interface will display the related policy levers for each TPM added.

To define and assess a Combined TPM package, take the following steps:

- Select the TPMs to be combined from **Policies >> Define a Combined TPM package** by ticking the appropriate boxes.
- Select the **Lever editor** to adjust the values for TPM variables.
- Click **Save** and add a title and an abstract to describe the policy.
- Select the saved combined TPM package from **Run >> Run a policy package**.

To make additions before running the simulation, enter the **Expert Mode** by ticking the box at the bottom left of the dialog (see Section 3.7).

3.1.3 Select a Customised Policy Package

The Customised Policy package enables you to select any combination of policy levers, which are organised in tabs according to the module.

To define and assess a Customised Policy package, take the following steps:

- Select policy levers from **Policies >> Define a Customised Policy package**.
- Select policy levers from the list by ticking the appropriate boxes and use the interface to modify values for the variables. Note that the tabs in each module contain different levers.

- Click **Save as a new package** and add a title and an abstract to describe the policy.
- Select the saved Customised Policy package from **Run >> Run a policy package**.
- To make additions before running the simulation, enter the **Expert Mode** by ticking the box at the bottom left of the dialog (see Section 3.7).

3.2 User Interface Menus

There are seven user interface menus:

- **Framework Conditions:** shows assumptions considered in the EU Reference Scenario 2013, which form the base scenario for HIGH-TOOL. These conditions can be changed using the **Expert Mode** (see Section 3.7).
- **Policies:** Shows all options related to the specification and management of policies (see Section 3.3).
- **Run:** Allows you to run any saved policy package, to manage ongoing runs, and to enter the **Expert Mode** (see Section 3.6).
- **Outputs:** Contains all options for the Policy Assessment Reports. When a run is completed, you are directed automatically to this area to view the synthesis indicators and to download the full Policy Assessment Report. You can revisit and load Policy Assessment Reports from previous runs, and export or delete them (see Section 3.8).
- **Export:** Enables you to export raw data from tables in the **Data Stock** (see Section 3.9).
- **User Profile:** Allows you to log in and log out, to access the help function (getting started, user manual, FAQ, and download reference reports). Administrators can also manage user profiles through this interface. This menu is separated from other menus and displayed on the right side of the screen.

For each of the policy packages (Single TPM, Combined TPM, Customised Policy package), several actions can be activated from the **Policy menu**:

- **Load a policy package:** select and upload a previously created policy package.
- **Delete a policy package:** delete a previously created policy package.
- **Save:** saves changes to a policy package loaded to the HIGH-TOOL interface.
- **Save as a new policy measure:** copy an active policy package under a new name.

3.3 Define Policies at Aggregated EU Level

Different policy intensities can be assessed for the TPMs. Recommended maximum and minimum values for all variables are provided, as well as reference baseline values.

3.3.1 Define Single Transport Policy Measures at Aggregated EU Level

The following information and options are provided as shown in Figure 10.

Variable	Start year	Select value	Unit	Reset	Time	Map
Change of level of service indicator for passenger road	2015	0	count			
Change of net time for passenger road	2015	97	percentage (100 = baseline)			
Technology related additional cost for B30 bus	2015	95	eur_veh (100 = baseline)			
Technology related additional cost for battery electric car	2015	95	eur_veh (100 = baseline)			
Technology related additional cost for battery electric van	2015	95	eur_veh (100 = baseline)			

Figure 10: Edit a Transport Policy Measure (TPM)

To define aggregated single transport policy measures, use the following sequence:

- Specify individual parameter and variable values using the options in the variable editor of each TPM.
- A pagination bar groups individual Transport Policy Measures (TPMs) according to the following dimensions: Internal Market; Research and Innovation; Efficiency Standards and Flanking Measures; and Pricing.




- For each of these policy dimensions, the TPMs are presented in a continuous list of boxes together with the variables associated with each TPM. The levers on a TPM are collapsed by default and can be expanded using the arrow at the left of the box (see Figure 10).
- Specify individual parameter and variable values using the options in the variable editor of each TPM.


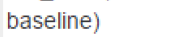




Table 1: Policy dimensions and TPMs considered

Internal Market	Research and Innovation	Efficiency Standards and Flanking Measures	Pricing
- Opening the internal rail market	- Road safety	- Improving local transport	- External costs
- Blue Belt	- Safer vehicles	- Car replacement	- Circulation tax cars
- Port services	- ITS traffic information	- Electric cars	- CO ₂ feebates
- IWW	- ITS dynamic traffic management	- H ₂ cars	- Urban road
- Single European road market	- ITS intelligent vehicles	- Maximum speeds	- Heavy duty charge
- ERA		- Enhance service quality at airports	
- Truck drivers		- City logistics	
- Freight corridor		- Promotion low emission road	
- Access to rail infrastructure		- New vehicles	
- Rail safety			
- Dangerous goods			
- ERTMS			
- River info system			
- Acceleration of TEN-T implementation			

The **variable editor** is organised by rows, each row corresponding to an input. The available options are presented from left to right (see Table 2).

Table 2: Options in variable editor

Option	Interface Display
A help icon and the name of the input parameter or variable.	 Better use of truck capacity
Select the year the policy comes into full effect. The default is 2015.	<input type="text" value="2015"/>
Use the slider to select a value for the input parameter for the year selected above. Move the slider to the left or right to set a new value. Minimum and maximum values are established for each input field. The default assumes the selected value applies uniformly from 2015 to 2050.	70  100
The colour of the semaphore is a linear gradient between the predefined value and the maximum and minimum values for the input field. Dark tones indicate that the selected value is far from the default value and lighter tones closer to the predefined value.	
A quantitative reference value corresponds to baseline policy intensity identified in HIGH-TOOL with 2011 White Paper policy aims and actions. This value can be updated manually.	<input type="text" value="90"/>

Option	Interface Display
A visual indicator gives the percentage distance of the chosen value from the reference value. Thus, +20% indicates the chosen value is 20% higher than the proposed reference value for that parameter.	-20% 0 +20% 
The unit of the indicator.	eur_vkm (100 = baseline) 
Reset button returns all values to the initial state for a given policy lever.	
The Numerical Editor icon presents the evolution of the input field in the period 2010–2050 in a table.	
The Graphical Editor icon presents the evolution of the input field in the period 2010–2050 graphically.	
The MAP Editor icon presents the geographical distribution of the input across Europe.	

Each policy lever targets a specific variable and set of dimensions, such as load time for rail affects the average loading time of freight on rail mode. Most policy levers are measured in relative terms to the baseline, but a few are expressed in absolute terms, such as road tolls per country, as indicated in the lever units. The TPM Acceleration of TEN-T implementation works differently. There are no explicit policy levers because transport impedances are changed internally to simulate faster implementation of TEN-T networks. To activate, click **Save this TPM** in the box for this special TPM.

3.3.2 Define Combined Transport Policy Measures at Aggregated EU Level

A more complex simulation of transport policies can be constructed by combining predefined TPMs. To add a TPM, tick the appropriate box in the options listed. For each TPM added, the interface displays the related policy levers (see Figure 11 and Figure 12).

HIGH-TOOL
Framework Conditions ▾
Policies ▾
Run ▾
Outputs ▾
Export ▾

Hi, HIGH-TOOL Test user ▾

Define a new Combined TPM package

Save

Policy Selector
Lever Editor

☒ Opening the internal rail market
Open the domestic rail passengers market to competition, including mandatory award of public service contracts under competitive tendering.

☐ Maritime traffic management system
Integrate the use of monitoring tools by all relevant authorities responsible for maritime traffic, ensure the full interoperability between ICT systems in the waterborne sectors, guarantee the monitoring of vessels and freight (Blue Belt) and set up appropriate port facilities (Blue Lanes).

☐ Enhance service quality at ports
Eliminate restrictions on provision for port services (by time and cost reductions).

Figure 11: Select a combination of TPMs with this interface

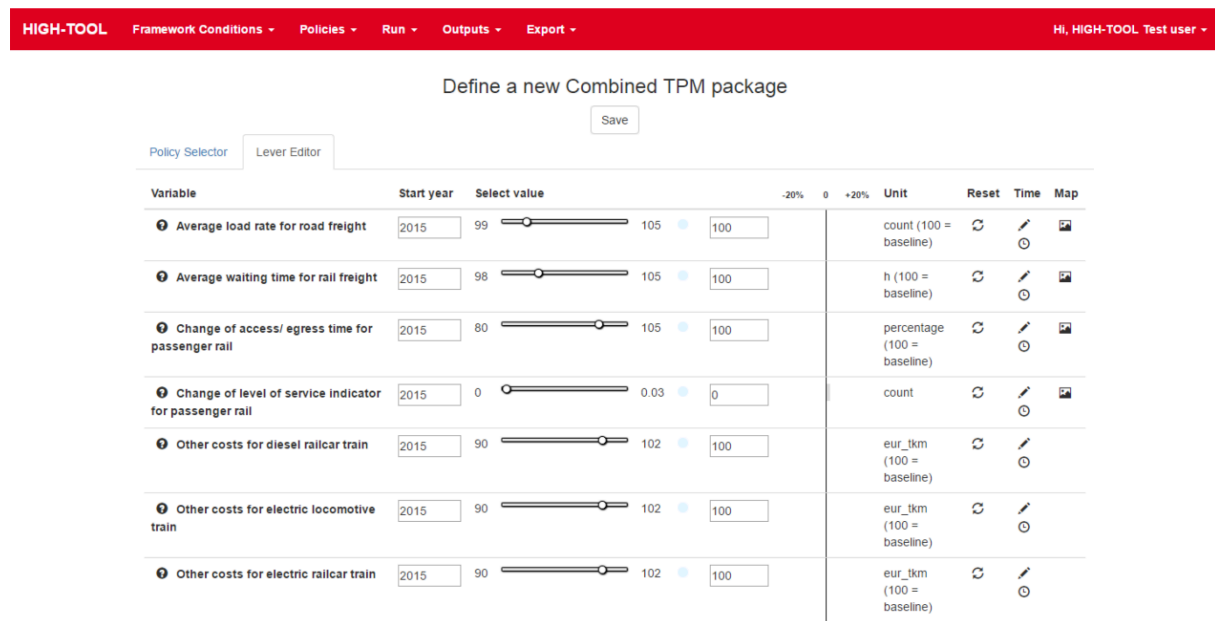


Figure 12: The policy levers for the Combined TPM package selected in Figure 11

While some policy levers are common to several TPMs, only one instance is shown in order to prevent contradictory information being entered. The lower and upper limits of the combined policy lever depend on the TPMs combined. All possible TPM combinations have been analysed, and in most cases the combined effect of TPMs is purely additive or only limited in some cases. The interface delivers common extended value ranges for the combined policy levers. When a combined policy lever is purely additive, the lower and upper limits are increased by adding the limits of each instance of the policy levers. For example, if one instance of the policy levers has $\pm 5\%$ and another has $\pm 10\%$, the combination will show $\pm 15\%$.

If a combination of TPMs has a limited effect, one of three formulations is applied to calculate the combined lower and upper limits of a policy lever. The formulation is automatically selected according to the nature of the combination and cannot be selected by the user. The three formulations are as follows:

- From all possible instances of a policy lever, maximum upper and minimum lower values are chosen.
- A combined limit is calculated by firstly adding the limits of the widest instance, then adding 50% of the limits of the second widest range, then 25% of the third widest instance and so on for each instance. If there are two instances of the same lever, one with $\pm 5\%$ limits and the other with $\pm 10\%$ limits, the combined limits will be $\pm 12.5\%$.

- A mix of the two formulations is used for some combinations of three TPMs. Firstly, a combined limit is calculated from two instances of the policy lever, and then the maximum of this value and the third instance is selected.

Apart from the policy lever limits, user interaction is the same as for the Single TPM menu and contains the same tools. You can modify the values for each policy lever at EU level, edit the time pathways, and apply different values for EU countries or regions (NUTS-2).

3.3.3 Define a Customised Policy Package at Aggregated EU Level

A customised policy package can be defined using any combination of policy levers. The policy levers are organised in tabs per module, and the number and classification are shown in Table 3, and the arrangement of the interface for a Customised Policy package in Figure 13.

Table 3: Number of policy levers per module for the Customised Policy package interface

Module	Number of individual levers
Economy and Resources	3
Vehicle Stock	430
Passenger Demand	100
Freight Demand	79
Environment	127
Safety	60

HIGH-TOOL Framework Conditions ▾ Policies ▾ Run ▾ Outputs ▾ Export ▾ Hi, HIGH-TOOL Test user ▾

Define a custom Transport Policy Measure (TPM)

« DEM Module ECR Module VES Module **PAD Module** FRD Module ENV Module SAF Module Policies without levers »

Save as a new package

Use	Variable	Start year	Select value	Unit	Reset	Time	Map
<input type="checkbox"/>	Average toll costs for coaches in Austria	2015	0	eur	↺	⌚	📍
<input type="checkbox"/>	Average toll costs for coaches in Belgium	2015	0	eur	↺	⌚	📍
<input type="checkbox"/>	Average toll costs for coaches in Bulgaria	2015	0	eur	↺	⌚	📍
<input type="checkbox"/>	Average toll costs for coaches in Croatia	2015	0	eur	↺	⌚	📍
<input type="checkbox"/>	Average toll costs for coaches in Cyprus	2015	0	eur	↺	⌚	📍

Figure 13: Interface for constructing a Customised Policy package

The interface with the policy levers is the same as that for a Single TPM. To activate a policy lever, tick the box for that lever. The list of policy levers is more extensive than for the Single TPM interface because some levers are not used in a predefined TPM but exist nonetheless, such as load capacity for rail, or purchase VAT for electric cars. The lower and upper limits for each policy lever are wider than those on the Single TPM interface, and give more scope to define more intense policies.

3.4 Define Time Evolution 2010–2050 for Input Variables

All policy levers have a default time profile that is defined by two user inputs – the final value and the year of application. An example of a default time profile, for which 80 is the selected value for the policy and 2020 the year of application, is shown in Figure 14.

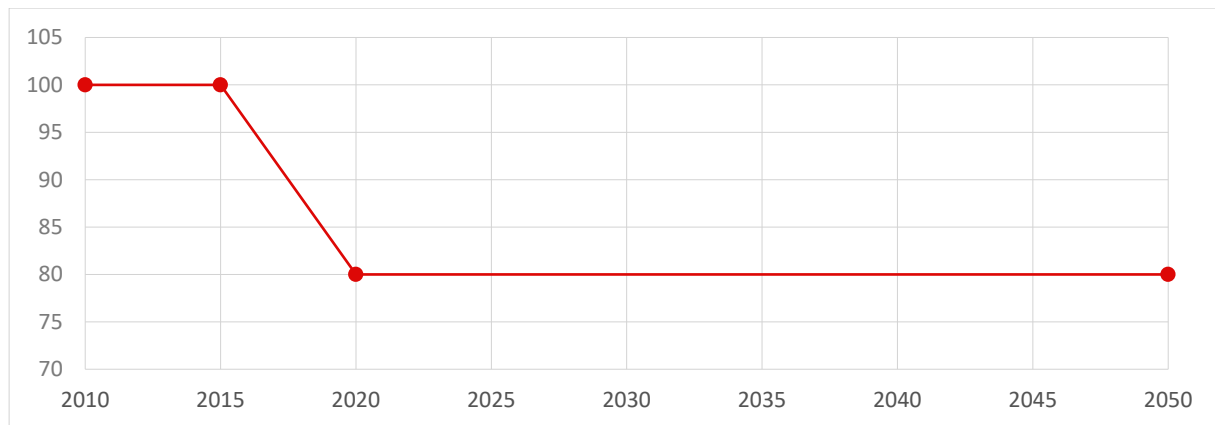




Figure 14: Default time profile for a policy lever

There are two tools to modify the time profile for a policy lever:

- The numerical editor selected by clicking icon 
- The graphical editor selected by clicking icon  (see Figure 15).

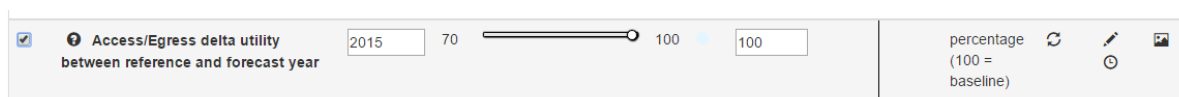
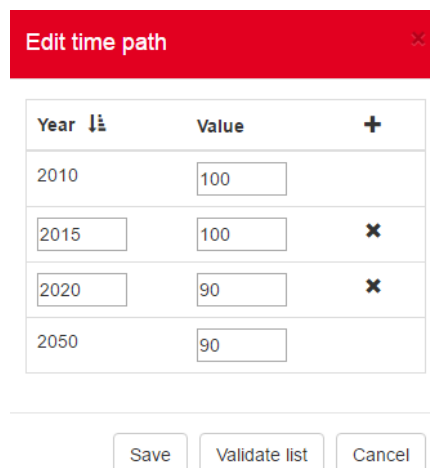


Figure 15: Access the numerical and graphical editors

The **numerical editor** is a table from which intermediate years and values for the policy lever are selected. This allows for progressive, stepwise implementation of certain policies. The path from the current situation in 2010 (e.g. *current level of road investments*) up to the final policy level (2050) can be reflected (e.g. *level of road investments in 2050*).

The following options are available (see Figure 16):

- To add a new row, click the icon **+** and in the boxes that appear, input a year and a value.
- Click the icon **⌵** to re-order the rows chronologically.
- Click the icon **✕** to remove a row.
- Click **Validate list** to correct automatically values beyond the bounds, to remove duplicate rows for the same year, and to order rows chronologically.
- Click **Save** to store all adjustments to the policy scenario.



Year ⌵	Value	+
2010	100	
2015	100	✕
2020	90	✕
2050	90	

Save Validate list Cancel

Figure 16: Interface for the numerical time path editor

For a more accurate and visual definition of the time path or time period of a policy lever, use the **graphical editor** with the years on the horizontal axis and the policy intensity on the vertical axis (see Figure 17).

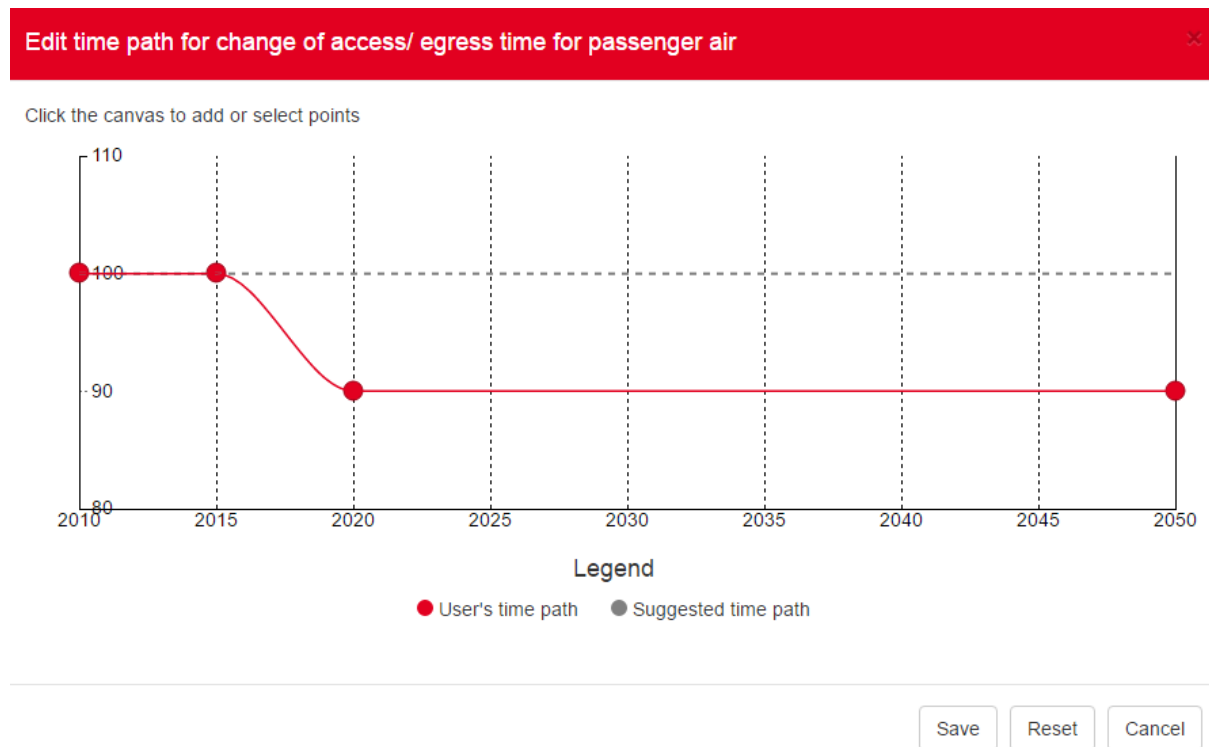


Figure 17: Interface for the graphical time pathway editor

In graphical editor, you can change any value shown in the graph by selecting and moving the red dots (except the fixed value for 2010), or insert a new control point by clicking on any point in the graph. When a new point is added, the application interpolates using Bezier curves. To delete a control point, click on the control point and press the delete key.

When opened for the first time in a policy lever, the time path editor shows the default time-period defined in the TPM editing interface, or that created with the numerical time path editor.

As a reference, a grey dotted path is shown as an initial suggestion. The time pathways defined by the numerical and graphical editors are applied uniformly to all 28 EU Member States. The curve shown is sampled at the exact calculation years (at five-year intervals in the period 2015–2050) for use by the mode. Thus, a maximum or minimum value for any year that is not a multiple of five is not considered in the calculations.

After saving a new time path, the icon in the main interface becomes red to indicate that values differ from the default.

Click the reset button on the main interface to remove all changes in the graphical editor.

3.5 Define Input Variables at Country and Regional Level


To access the **map editor**, click the icon  for any policy lever in the **Transport Policy Measures editor** (see Figure 18).



Figure 18: Access the map editor

Use the map editor to specify values for the various regions in Europe. For example, level of road investment may be set higher for countries in Eastern Europe than for those in Western Europe.


Click the **map editor** icon  to open the map of Europe (see Figure 19). The default of an input parameter or variable is displayed uniformly throughout Europe in a homogeneous colour.



Figure 19: Homogeneous geographical distribution of a parameter

As some policies might be more or less appropriate for some Member States, selectors in the dialog can be used to change the distribution of the policy based on different criteria (see Figure 20):

- Homogenous distribution (default setting)
- Proportional/inversely proportional to population density
- Proportional/inversely proportional to income per capita.

For example, the intensity of road pricing can be set higher in wealthy areas than in some other areas. Alternatively, the intensity of CO₂ taxation can be set higher in more densely populated areas of Europe than in sparsely populated areas.

These predefined settings are applied always in the same direction, regardless of the meaning of "more intensity" of the policy. So when choosing, for instance directly proportional to population density, the policy will take higher values for more densely populated regions and lower for the less dense regions, irrespective of whether higher values imply less intensity. If the effect obtained by using a predefined setting is contrary to the one desired, choose the opposite pre-set setting.

Territorial distributions of input parameters can be defined automatically based on country (NUTS-0) or region (NUTS-2).

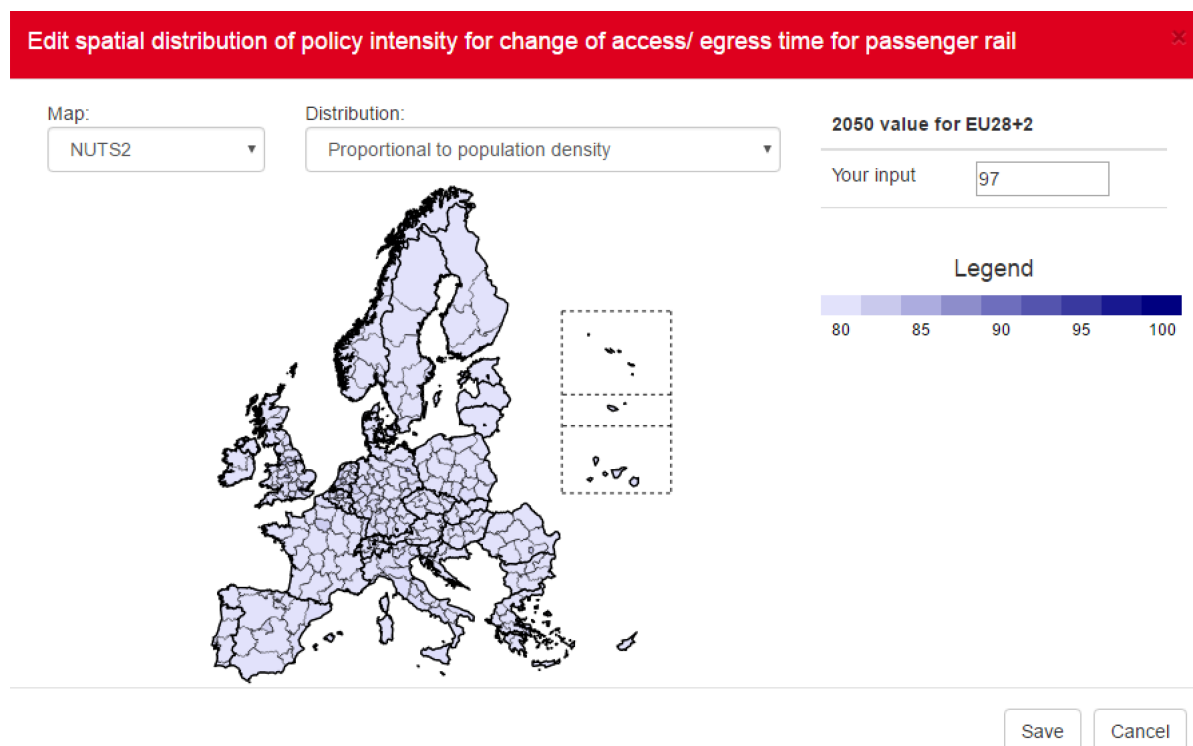


Figure 20: Geographic distribution of a parameter (proportional to population density of regions (NUTS-2))

A specific value for a country or region can be changed manually by clicking on the country or region and changing the input parameter on the right of the map editor (Your input option, see Figure 21). Hover the mouse over a region to display the region name and parameter value in 2050. Double click an area on the map to zoom in for more territorial detail.

Manual data input changes the representation of a region to a striped pattern in order to keep track of active modifications.

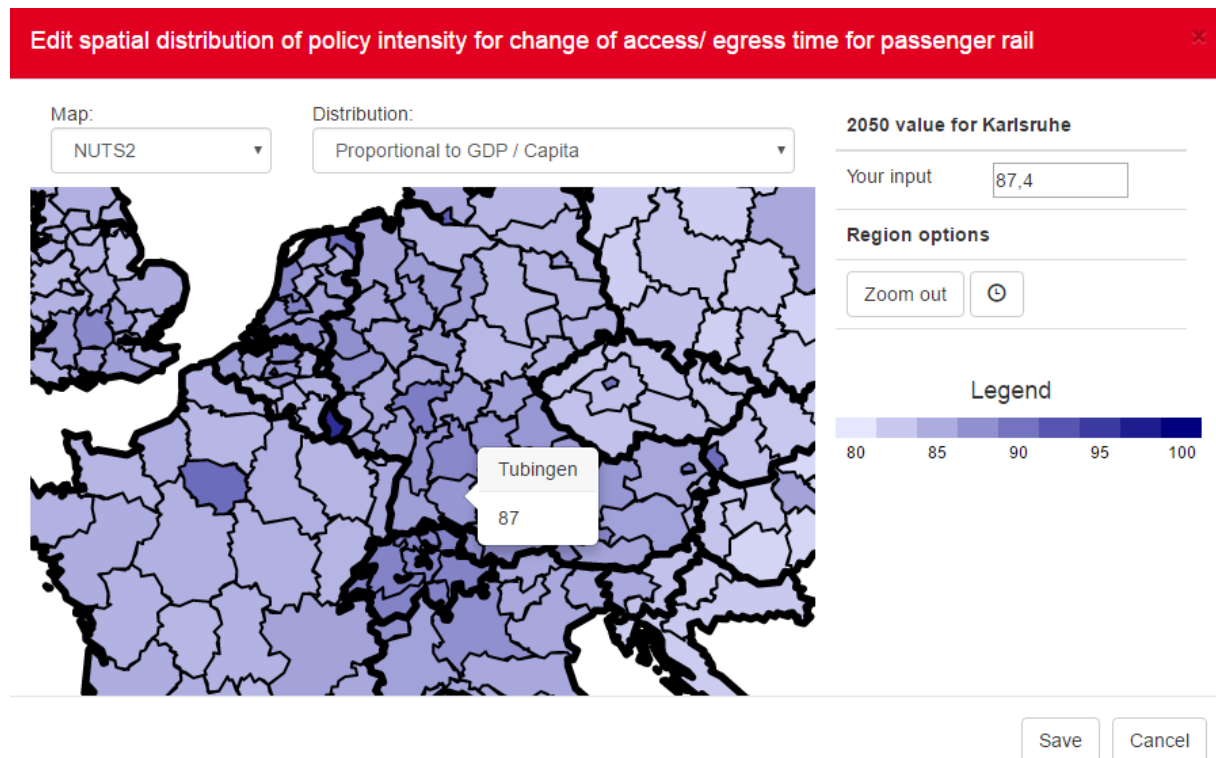



Figure 21: Manual change of a value for a specific region

When a specific country or region is selected, there is the option to input a time pathway using the  icon. This launches a new window with a graphical editor that operates in the same way as explained on Section 3.4.

The country/region time editor is shown in Figure 22. After setting the pathway by adding or removing control points, click **Set** to save the changes. **Reset to EU28** to reset the pathway throughout the EU 28, and then click **Done** to return to the map.

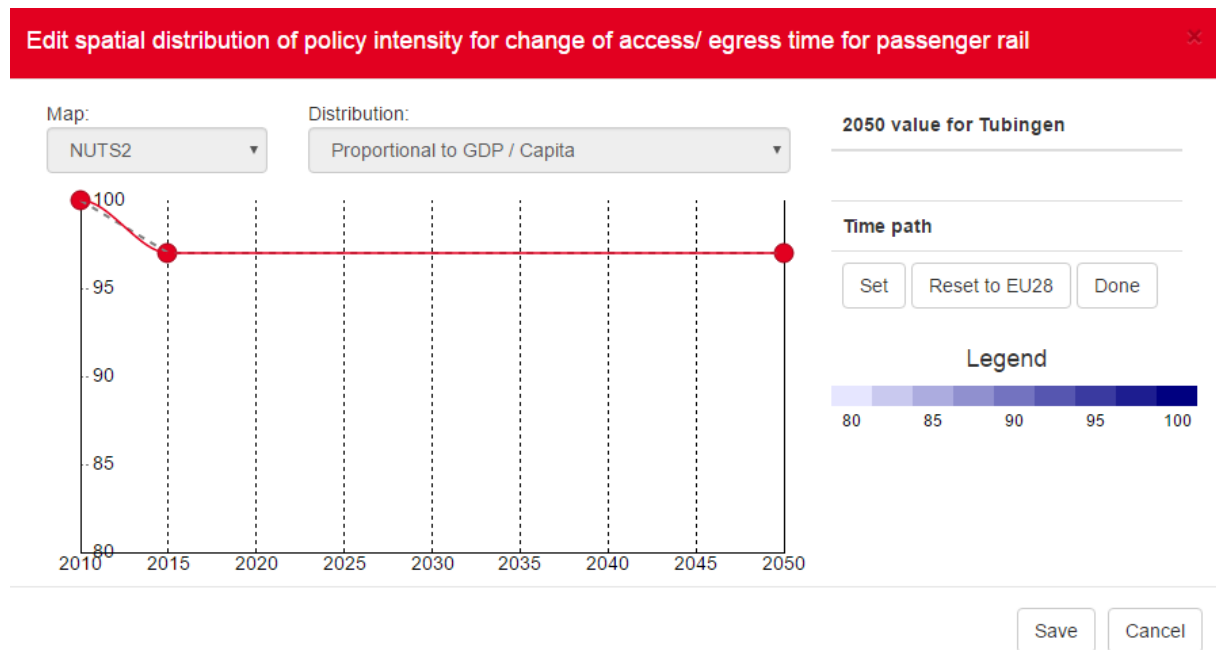


Figure 22: Graphical time editor for country or region

When the new map is saved, the icon in the main interface becomes red to indicate that values differ from the default. To delete all changes made in map editor, click **Reset** on the main interface.

3.6 Run a Saved Policy Package

The **Run** menu enables you to select and run any saved policy package. Select the option from the menu **RUN >> Run a policy package**. Click the policy package to run from the list and press **Select** at the bottom right to send the package to the run queue (see Figure 23). Before sending the package to run, inputs from the Data Stock can be manually edited in **Expert Mode**. Tick the bottom left option to activate the **Expert Mode** (see Section 3.7).

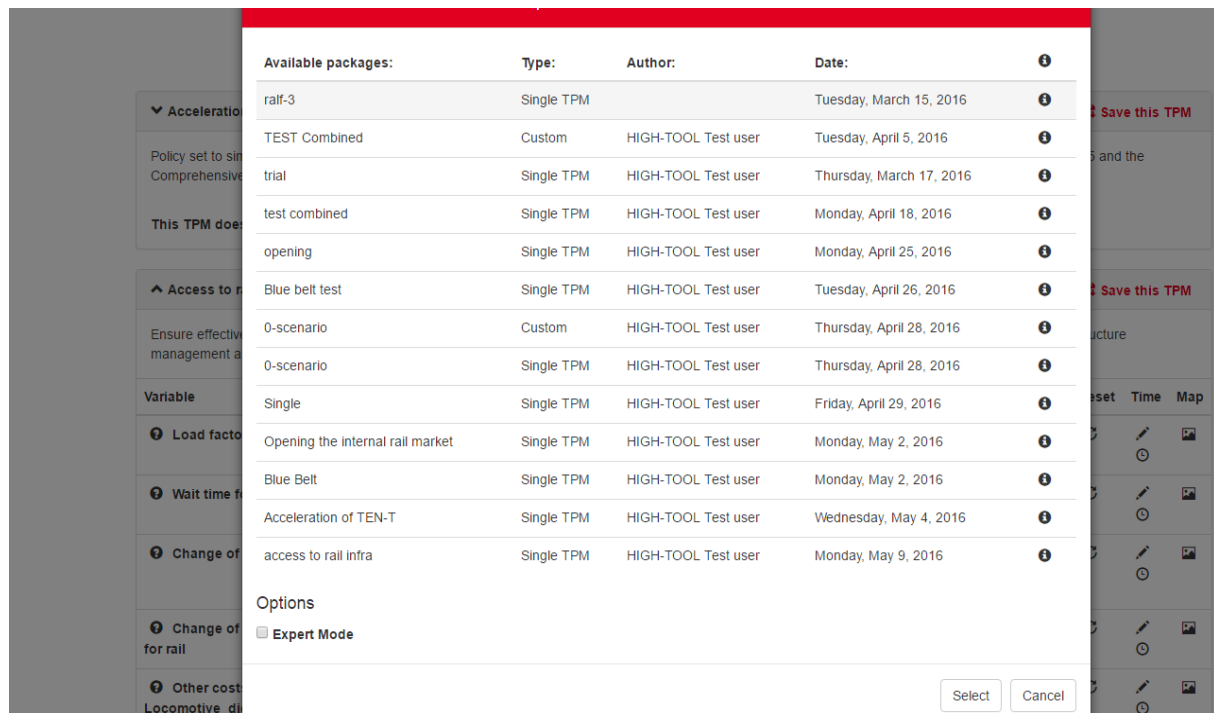


Figure 23: Select a policy package to run

3.7 Expert Mode

After defining a transport policy measure in one of the three available procedures (Single TPM, Combined TPM package, Customised Policy package), you can enter **Expert Mode** to edit input tables and/or the **Hyper-Network** to control the impedances used in the model. The Expert Mode is an optional feature for advanced editing of database values before running the model. The Expert Mode is used after changes have been made to the TPMs because these changes have to be applied in advance to be displayed in the raw tables. The workflow in the model is displayed in Figure 24.

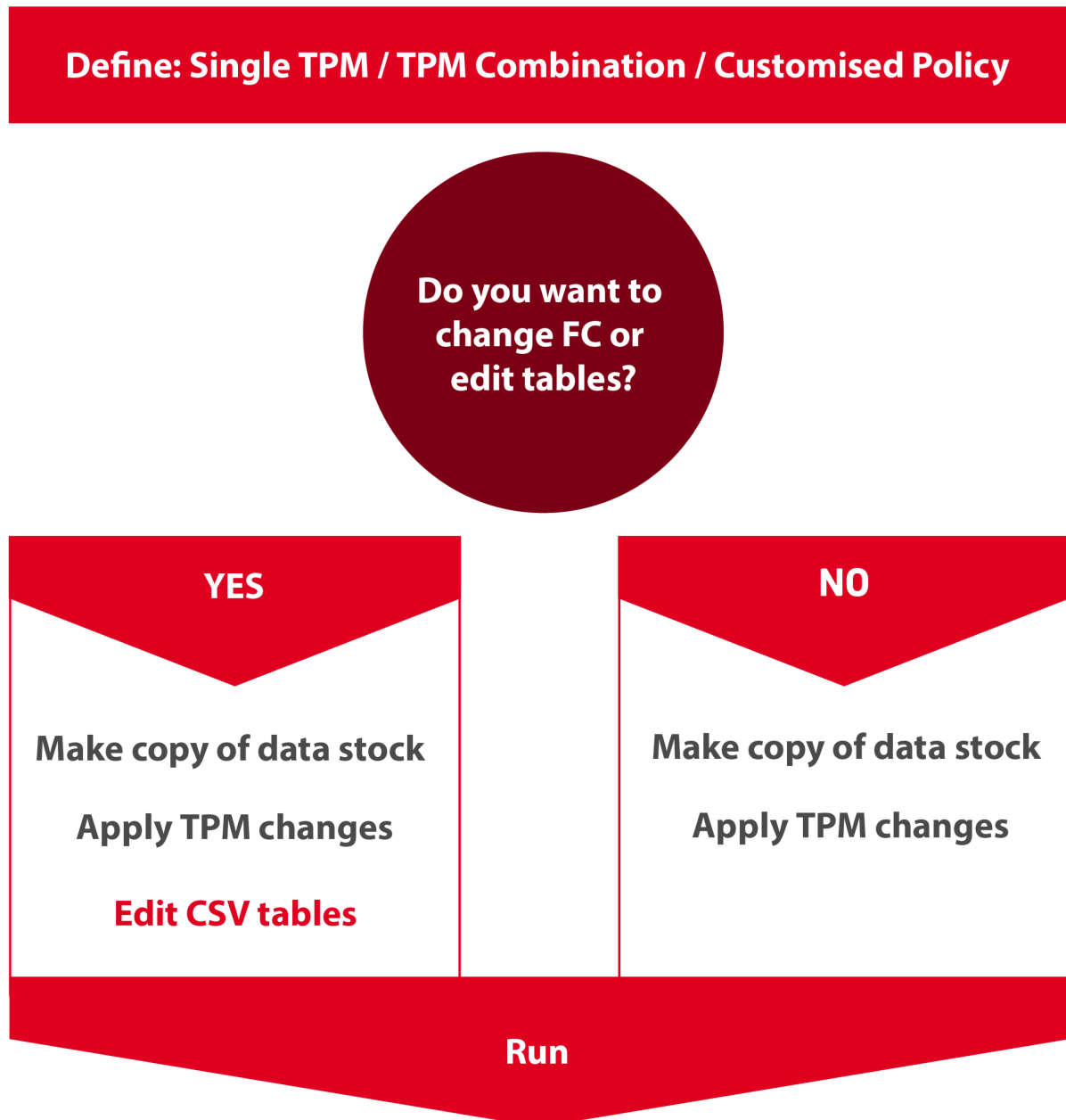


Figure 24: Workflow of the Interface

Use the **Expert Mode** to check and adjust variables that have been affected by changes in policy levers, and to change other model parameters or inputs, such as Framework Conditions. To enter **Expert Mode**, tick the box in the window to select a policy package to run (see Figure 25).

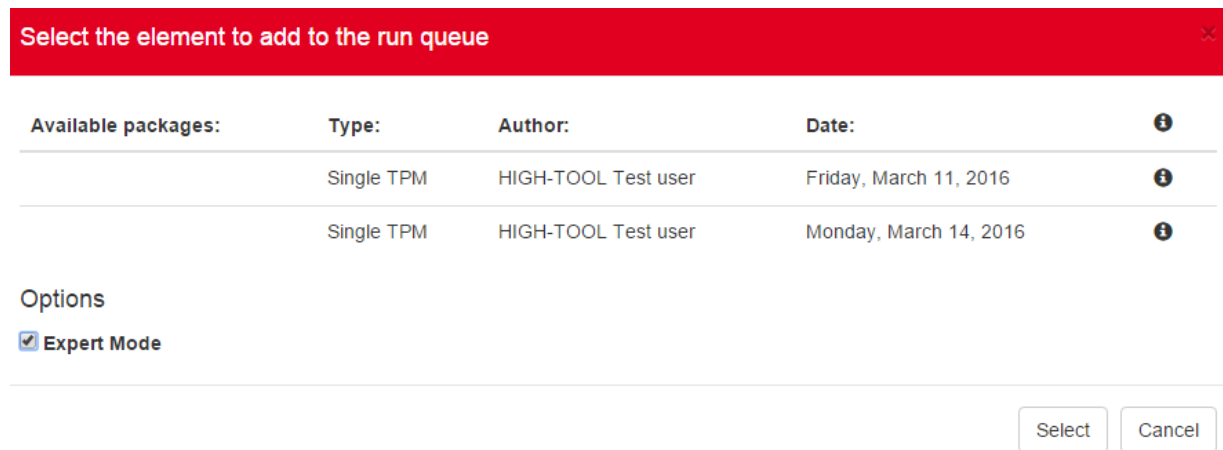


Figure 25: Activate the Expert Mode

When the policy package to run with the **Expert Mode** has been launched, the system copies the data stock including the modifications to it. When the copy is completed, click the icon in the **View and manage your model runs** window, or select **RUN >> Packages ready for Expert Mode**, and then select the policy package to edit from the list. This will open a new window (see Figure 26).

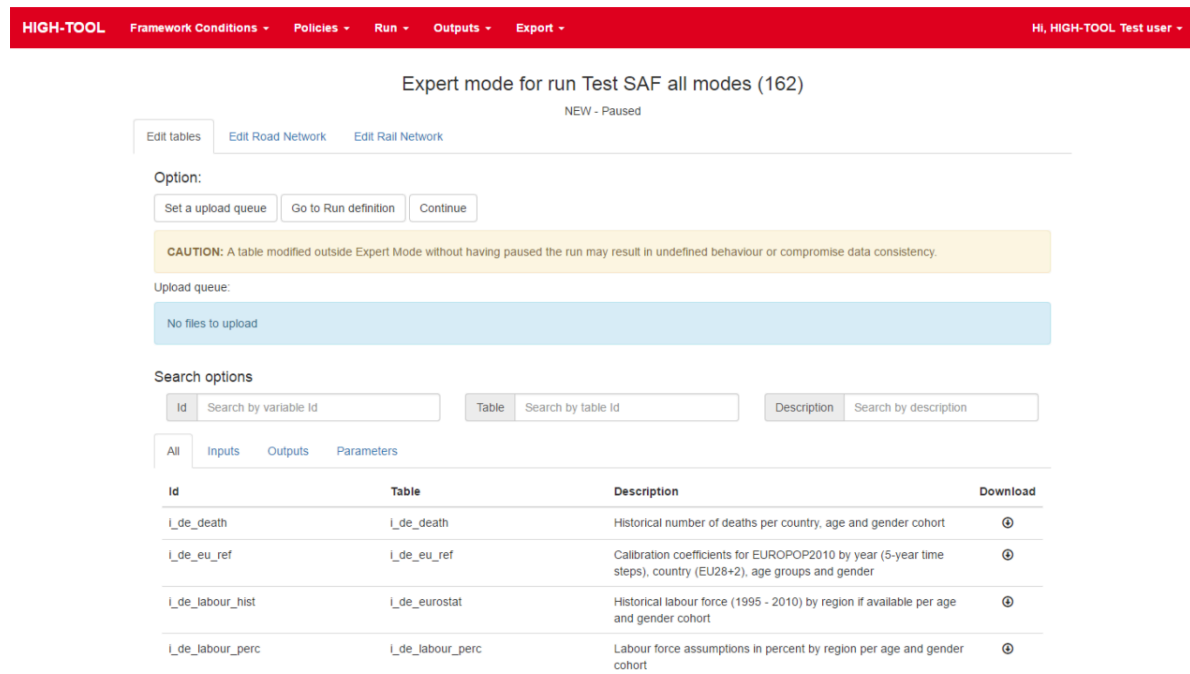


Figure 26: Expert mode interface


In the **Expert Mode** interface, you can access two tools – **Table Editor** and **Hyper-Network editor** – using the tabs on the upper part of the interface.

3.7.1 Edit Tables

The **Edit Tables** tool (see Figure 26) connects directly to the **Data Stock** to show the full list of input variables, the table they belong to, and a description. Three search fields enable fast and easy filtering of the items displayed.

The inputs are policy levers, Framework Conditions and model parameters. Manually modifying any of these inputs could lead to meaningless model results if the values selected are outside the limits of applicability, as this might imply the need for recalibration of the equations inside each module. See HIGH-TOOL Deliverable D4.3 (van Grol et al., 2016) and consult the metadata in the tables in the **Data Stock** before using this feature.

To change an input value:

- Use the search fields to find the input value.
- Click the icon  to download the table.
- Open the downloaded csv file with a spreadsheet editor, modify and save the value (see the Data Stock documentation to obtain a list of the codes used in each table).
- Click **Set upload queue** to upload the table and select the modified csv file using the file explorer.

These steps are repeated for each input value. When all variables have been modified, click **Upload all valid tables**. This button appears when there is at least one table in the upload queue. In the run window (see Figure 27), click the resume icon to continue the simulation.

HIGH-TOOL
Framework Conditions -
Policies -
Run -
Outputs -
Export -
Hi, HIGH-TOOL Test user -

View and manage your model runs

Id	Alias	Status	Step Id	Step Description	Run progress	Actions
153	Introducing alcolocks in Car, Truck and PT vehicles	Idle	DONE	Finished. Ready to produce reports	<div></div>	
157	Case1_FT	Idle	DONE	Finished. Ready to produce reports	<div></div>	
162	Test SAF all modes	Active	NEW	In queue to create schema	<div></div>	

View and manage other users' runs

Schema	Alias	Owner	Status	Step	Run progress	Actions
137	Reduction of loading/unloading and waiting time for rail freight	Guest	Idle	<div></div>	DONE	
138	Improvement of Magistrale rail corridor	Guest	Idle	<div></div>	DONE	

Figure 27: Resume a run after Expert Mode

3.7.2 Edit Hyper-Network

The network impedances in transport modes can be changed in an aggregated way through the policy levers in the TPM interfaces. To explore and make detailed changes to the network, the **Expert Mode** has the **Hyper-Network** interface, which is a graphical representation of the road and rail connections between (NUTS-2) regions (see Figure 28).

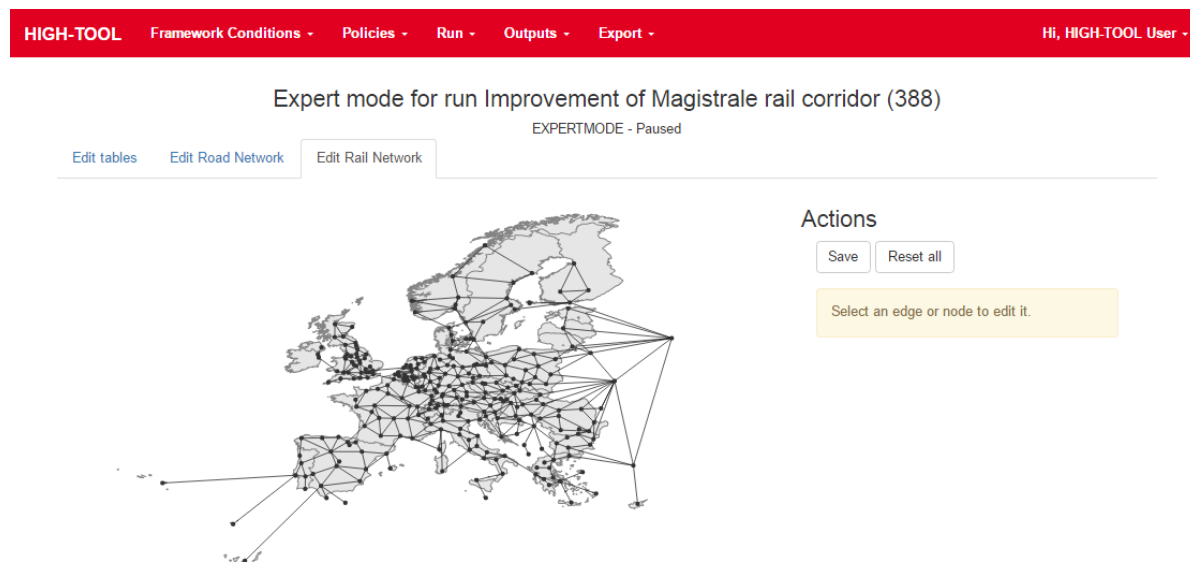


Figure 28: Edit the road Hyper-Network

The **Hyper-Network** editor has a navigable map that can be zoomed using the mouse wheel. Click on an edge to display associated data to the right of the screen. Data can be input to fields for the relative time and distance weights for the different years. The values of time and distance for a given relation can be changed in relative terms.

Click a node to display associated data to the right of the screen. Input data on the fields for the relative access/egress time and distance weights for the different years. Absolute values of time and distance for a given relation cannot be changed but can affect it by setting the relative change. Click **Save** to store the values, edited edges and nodes are shown in red. Use Reset to restore the values to their initial state. All changes to the edges and nodes are used to compute new impedances for the **Passenger** module.

3.8 Policy Assessment Report

The full simulation results are presented in a report in MS EXCEL format downloadable from the server through the User Interface. The report is generated automatically by the Interface and designed as an interactive Excel report. Tables, graphs or single values can be imported to a presentation tool (MS PowerPoint) or a text editor (MS Word, OpenOffice) using copy and paste functions.

The Policy Assessment Report comprises the following elements:

- **Contextual Information** including the scenario name and abstract.
- **Model inputs** comprising a list of all inputs entered using the TPM editors. For each policy lever active, it shows policy intensity for the 2010–2050 period, a map of the changes in policy intensity across the EU territory (if any), and the specific policy intensities 2010–2050 for each country/region with customised changes (if any).
- **Results for each thematic area** (Demography, Economy and Resources, Passenger Demand, Freight Demand, Vehicle Stock, Environment, Safety) are presented in tables and graphs, each on a separate page. Results are presented in absolute values and compared with the baseline scenario.

The following sequence of figures illustrates the configuration of the assessment report (Figure 29 to Figure 32).



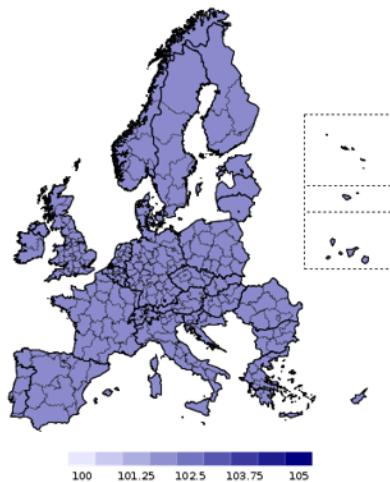
Figure 29: Main menu of the Policy Assessment Report in MS Excel

MODEL INPUTS

Load factor for rail in count (100 = baseline)

Year	EU28 Value
2010	100
2015	102
2020	102
2025	102
2030	102
2035	102
2040	102
2045	102
2050	102

EU28 + NO + CH at NUTS2 Level



Custom region values

Figure 30: Model inputs to the Policy Assessment Report

DEMOGRAPHY TABLES

European population by gender (in million) SCENARIO

Year	Male	Female	Total	% Male	% Female
2010	266	253	519	51.3%	48.7%
2015	258	269	527	49.0%	51.0%
2020	262	272	534	49.1%	50.9%
2025	265	275	540	49.1%	50.9%
2030	267	276	543	49.2%	50.8%
2035	268	278	546	49.1%	50.9%
2040	269	278	547	49.2%	50.8%
2045	269	278	547	49.2%	50.8%
2050	269	277	546	49.3%	50.7%

European population by gender (in million) BASELINE

Year	Male	Female	Total	% Male	% Female
2010	266	253	519	51.3%	48.7%
2015	258	269	527	49.0%	51.0%
2020	262	272	534	49.1%	50.9%
2025	265	275	540	49.1%	50.9%
2030	267	276	543	49.2%	50.8%
2035	268	278	546	49.1%	50.9%
2040	269	278	547	49.2%	50.8%
2045	269	278	547	49.2%	50.8%
2050	269	277	546	49.3%	50.7%

European population by gender (in million) DIFFERENCE

Year	Male	Female	Total
2010	0	0	0
2015	0	0	0
2020	0	0	0
2025	0	0	0
2030	0	0	0
2035	0	0	0
2040	0	0	0
2045	0	0	0
2050	0	0	0

European population by age cohort (in millions) SCENARIO

Year	0-19	20-39	40-59	=>60	% (0-19)	% (20-39)	% (40-59)	% (>60)
2010	110.8	141.1	146.3	157.7	21.4%	27.2%	28.2%	23.1%
2015	109.9	136.9	149.2	130.1	20.8%	26.0%	29.4%	24.7%
2020	110.6	132.1	149.3	141.0	20.7%	24.6%	29.0%	26.5%
2025	110.8	127.3	147.3	153.0	20.6%	23.6%	27.4%	28.4%
2030	109.2	124.3	144.0	164.8	20.1%	22.8%	26.6%	30.4%
2035	106.8	123.5	140.5	174.0	19.6%	22.7%	26.8%	31.8%
2040	105.4	124.1	136.0	180.8	19.3%	22.7%	24.8%	33.1%
2045	105.1	124.1	131.4	186.0	19.2%	22.7%	24.0%	34.0%
2050	105.4	122.1	128.4	189.6	19.3%	22.4%	23.8%	34.6%

European population by age cohort (in millions) BASELINE

Year	0-19	20-39	40-59	=>60	% (0-19)	% (20-39)	% (40-59)	% (>60)
2010	110.8	141.1	146.3	157.7	21.4%	27.2%	28.2%	23.1%
2015	109.9	136.9	149.2	130.1	20.8%	26.0%	29.4%	24.7%
2020	110.6	132.1	149.3	141.0	20.7%	24.6%	29.0%	26.5%
2025	110.8	127.3	147.3	153.0	20.6%	23.6%	27.4%	28.4%
2030	109.2	124.3	144.0	164.8	20.1%	22.8%	26.6%	30.4%
2035	106.8	123.5	140.5	174.0	19.6%	22.7%	26.8%	31.8%
2040	105.4	124.1	136.0	180.8	19.3%	22.7%	24.8%	33.1%
2045	105.1	124.1	131.4	186.0	19.2%	22.7%	24.0%	34.0%
2050	105.4	122.1	128.4	189.6	19.3%	22.4%	23.8%	34.6%

Figure 31: All results displayed in tables per theme

PASSENGER DEMAND GRAPHS

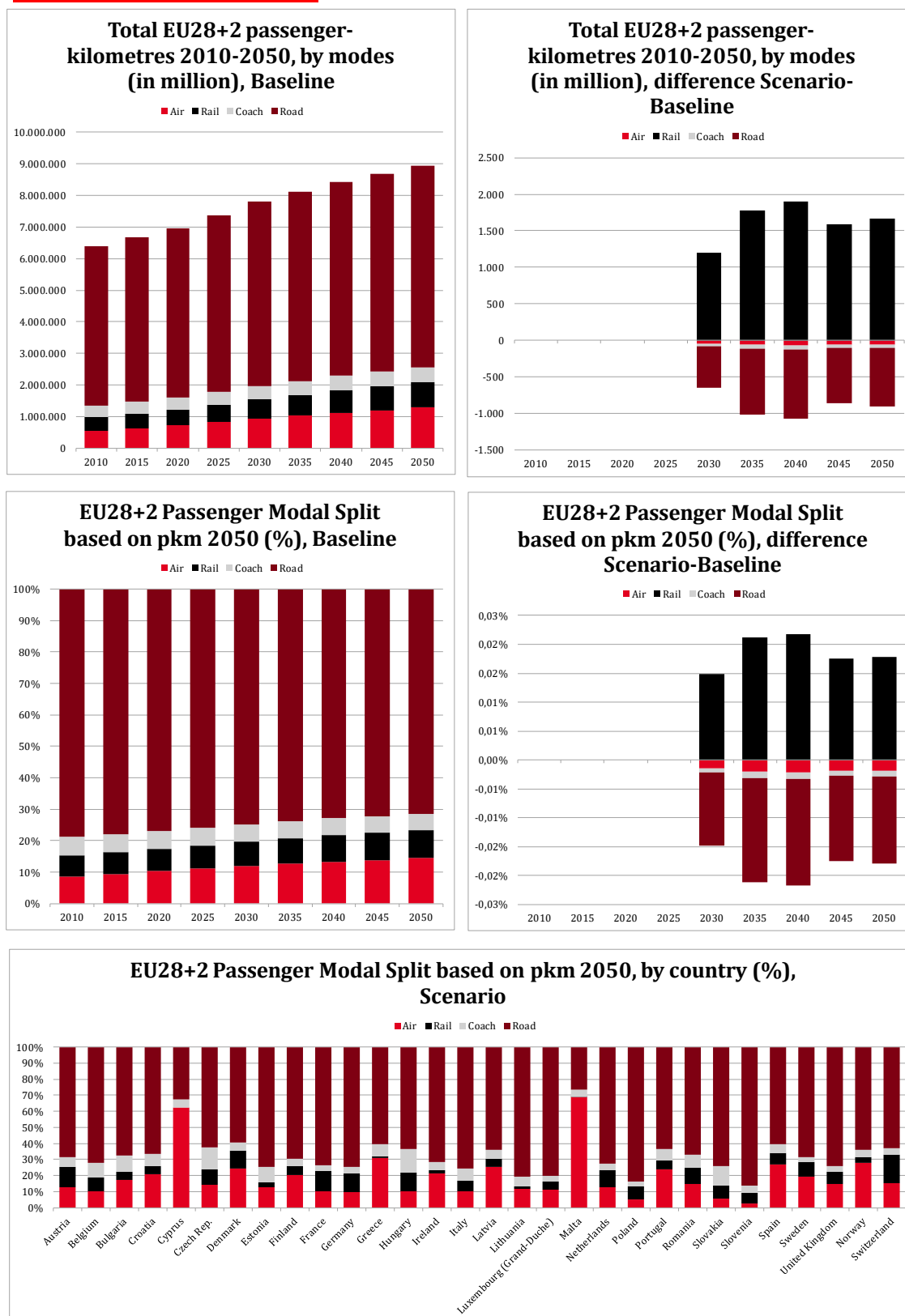


Figure 32: All results displayed in graphs per theme

3.9 Export of Results

The export menu enables raw data from tables in **Data Stock** to be exported in CSV format.

Select the database corresponding to an existing model run. The User Interface shows all variables for a specific run. Variables can be filtered by restricting the search to specific strings in the variable name, the table name to which the variable belongs, or parts of the description of such variable.

The variable contents can be retrieved by clicking the icon **Download**.

Export table contents

Select database schema:
High-Tool Baseline (high_tool) --- Status : Idle

Search options

Id Search by variable Id Table Search by table Id Description Search by description

Inputs **Outputs** Parameters

Variable	Table	Description	Download
i_de_labour_hist	i_de_eurostat	historic labour force (1995 - 2010) by age and gender cohort	ⓓ
i_de_labour_perc	i_de_labour_perc	labour force assumptions	ⓓ
i_de_death	i_de_death	historic number of deaths per country per age and gender cohort	ⓓ
i_de_pop_disag	i_de_pop_disag	historic shares of population 2010 at nuts-2 level per age and gender	ⓓ
i_de_pop_eurostat	i_de_eurostat	historic population (1995 ? 2010) by age and gender cohort	ⓓ
i_de_life_men	i_de_europop_ass	projected life expectancy for men for eu27 countries +ch +no from 2010 ? 2050 (5-year time step)	ⓓ
i_de_life_women	i_de_europop_ass	projected life expectancy for women for eu27 countries +ch +no from 2010 ? 2050 (5-year time step)	ⓓ
i_de_net_migration	i_de_europop_ass	projected net migration (emigration-immigration) for eu27 countries +ch +no from 2010 ? 2050 (5-year time step)	ⓓ
i_de_tot_fert_rate	i_de_europop_ass	projected total fertility rate for eu27 countries +ch +no from 2010 ? 2050 (5-year time step)	ⓓ
i_de_eu_ref	i_de_eu_ref	the calibration coefficients for europop2010 by year (5-year time steps), country (eu27 countries + no + ch), agegroups (0,5, 75) and gender (0,1)	ⓓ
i_de_urban	i_de_urban	urbanisation proxy per nuts-2 region	ⓓ
i_fd_region_share	i_fd_region_share	region shares by o/ d and mode for travelled distance	ⓓ
i_fd_imp_dist	i_fd_imp	distance impedances od and mode based	ⓓ
i_fd_route_choice	i_fd_route_choice	tonne share by route chains using two transshipment points	ⓓ

Figure 33: Control panel for export of raw data

4 Application Examples

Examples of the application of HIGH-TOOL to policy questions are presented. Each example starts with the policy question and explains how to translate this into inputs for the model, how to run the model and to obtain results. These examples are applicable to the online and to stand-alone versions of the HIGH-TOOL model.

4.1 Example 1: Predefined Transport Policy Measure

Policy question: *What would be the effect of eliminating restrictions on port services to improve port quality?*

HIGH-TOOL provides a predefined transport policy measure, which can be selected.

4.1.1 Introducing the Policy Package

The first step consists of selecting the predefined TPM from the top menu by selecting **Policies** → **Define a Single Transport Policy Measure (TPM)** as shown in Figure 34.

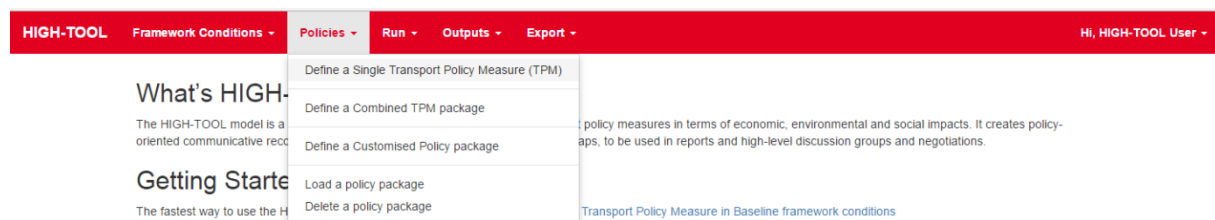


Figure 34: Accessing the single TPM menu

This presents a list of all available predefined TPMs of HIGH-TOOL, classified in four categories that can be explored using the tabs in the second line of the window (see Figure 35).

Define a Single Transport Policy Measure (TPM)

« **Internal market** Research and innovation Efficiency standards and flanking measures Pricing »

▼ Acceleration of TEN-T implementation Save this TPM

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

This TPM does not have associated levers.

▼ Access to rail infrastructure Save this TPM

Ensure effective and non-discriminatory access to rail infrastructure, including rail-related services, in particular through structural separation between infrastructure

Figure 35: Selecting a single TPM

Under the tab **Internal market**, select **Enhance service quality at ports**. To check that this is appropriate to model your policy question, read the TPM description on the interface and in deliverable D2.2 of HIGH-TOOL. **Click** the chosen policy to access the associated policy levers (see Figure 36).

▲ Enhance service quality at ports Save this TPM

Eliminate restrictions on provision for port services (by time and cost reductions).

Variable	Start year	Select value	-20%	0	+20%	Unit	Reset	Time	Map
1 Non-fuel operational cost for LNG ship	2015	80	100	90	eur_veh (100 = baseline)				
2 Non-fuel operational cost for bunker or Heavy Fuel Oil (HFO) fuelled ship	2015	80	100	90	eur_veh (100 = baseline)				
3 Non-fuel operational cost for distillate fuel (marine gas oil (MGO)/marine diesel oil (MDO)) fuelled ship	2015	80	100	90	eur_veh (100 = baseline)				
4 Non-fuel operational cost for Low Sulphur Heavy Fuel Oil (LSHFO) fuelled ship	2015	80	100	90	eur_veh (100 = baseline)				
5 Average loading time for inland waterways freight	2015	90	105	95	h (100 = baseline)				
6 Average loading time for sea freight	2015	90	105	95	h (100 = baseline)				
7 Average unloading for inland waterways freight	2015	90	105	95	h (100 = baseline)				
8 Average unloading for sea freight	2015	90	105	95	h (100 = baseline)				
9 Average waiting time for inland waterways freight	2015	85	105	90	h (100 = baseline)				

Figure 36: Policy levers for the single TPM enhance service quality at ports

The default for each TPM is the values predefined by the HIGH TOOL project, and are a good starting point to test a policy. However, you can modify the values of any policy lever in the following ways:

- The starting year for the policy.
- The intensity of the policy with respect to the baseline conditions or in absolute value depending on the policy.
- The evolution of the policy intensity in the simulation period (up to 2050).
- The geographical distribution.

More information on modifying policy levers is presented in Sections 3.3, 3.4 and 3.5.

For this example, the proposed values are used. The TPM can be saved as a new policy package by clicking the red icon **Save this TPM** at the right side of the TPM heading. This opens a dialog that requires the input of information (see Figure 37) as follows:

- Title: a short name (one or several words) to be displayed in the list of saved policy packages
- Headline: summarising the policy package to be shown in the scenario run manager
- Abstract: a brief text describing the policy to be modelled and the model inputs. This can be a copy-paste from a document.

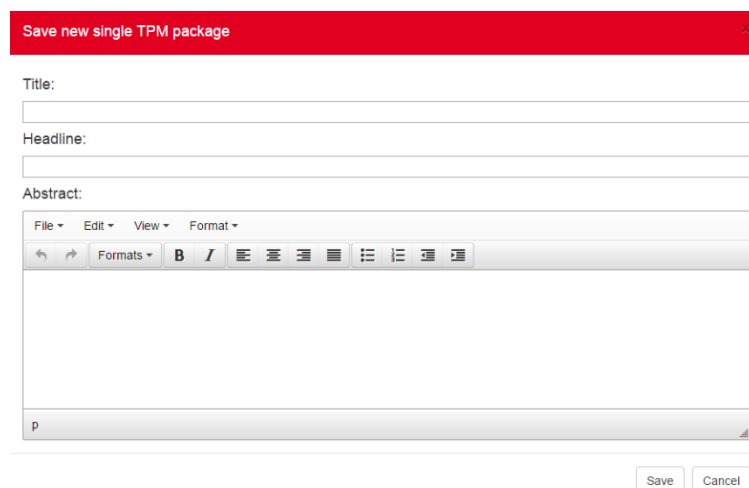


Figure 37: Dialog for single TPM with title, headline abstract

In this example, the title and headline are the same: ***Enhance service quality at ports***. After entering the information, click **Save** to close the dialog. The new policy package is ready to run.

4.1.2 Running the Policy Package

The second step of the simulation consists of selecting and running the previously defined policy package, in this example as a single TPM. Navigate to **Run → Run a policy package** in the top menu to open a dialog with all the saved policy packages (see Figure 38).

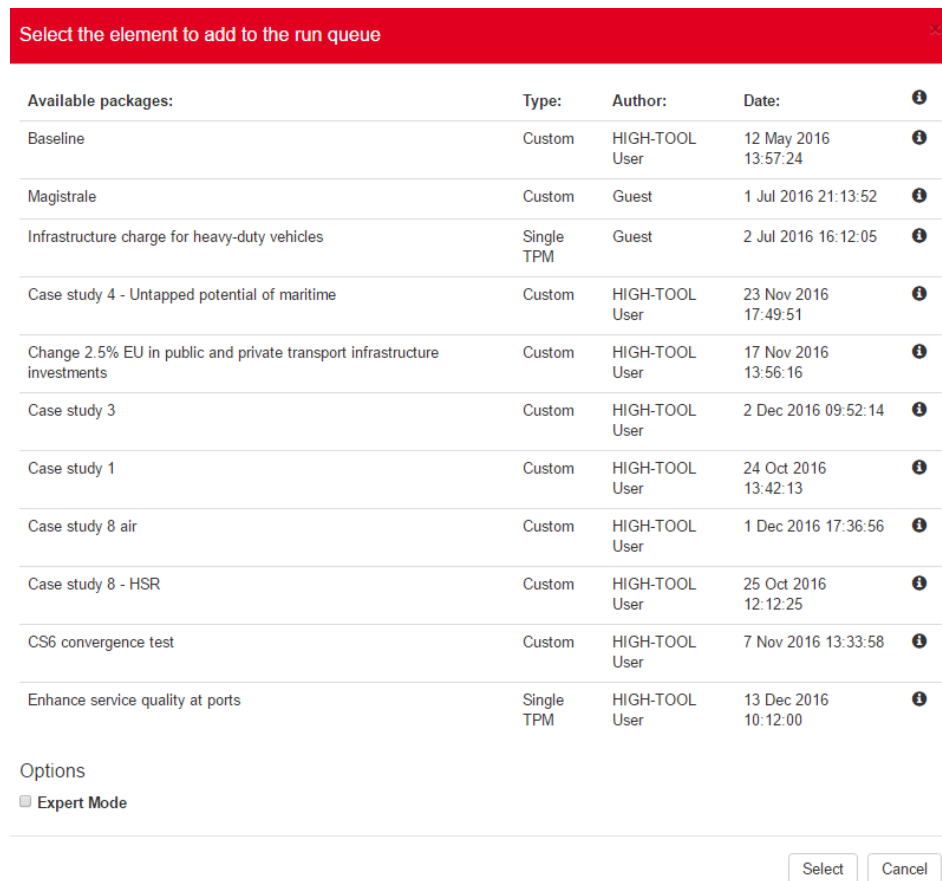


Figure 38: Policy package selector

Scroll down to the last option to find the newly created policy package: **Enhance service quality at ports**. Click the row to highlight in grey, and then click **Select** at the bottom right of the dialog. The interface then closes the dialog and shows the model run window. Our policy package runs at the end of the list of runs (see Figure 39) with the row highlighted in green, indicating the system is working on the simulation.

View and manage your model runs

Id	Alias	Status	Step Id	Step Description	Run progress	Actions
273	Baseline	Idle	<div>DONE</div>	Finished. Ready to produce reports	<div></div>	<div> <div> <div>👁</div> <div>⬇</div> <div>✎</div> </div> <div> <div>⏸</div> <div>✖</div> </div> </div>
333	Baseline	Idle	<div>DONE</div>	Finished. Ready to produce reports	<div></div>	<div> <div> <div>👁</div> <div>⬇</div> <div>✎</div> </div> <div> <div>⏸</div> <div>✖</div> </div> </div>
334	Baseline	Idle	<div>DONE</div>	Finished. Ready to produce reports	<div></div>	<div> <div> <div>👁</div> <div>⬇</div> <div>✎</div> </div> <div> <div>⏸</div> <div>✖</div> </div> </div>
335	Baseline	Idle	<div>DONE</div>	Finished. Ready to produce reports	<div></div>	<div> <div> <div>👁</div> <div>⬇</div> <div>✎</div> </div> <div> <div>⏸</div> <div>✖</div> </div> </div>
336	Change 2.5% EU in public and private transport infrastructure investments	Idle	<div>DONE</div>	Finished. Ready to produce reports	<div></div>	<div> <div> <div>👁</div> <div>⬇</div> <div>✎</div> </div> <div> <div>⏸</div> <div>✖</div> </div> </div>
337	Baseline	Idle	<div>DONE</div>	Finished. Ready to produce reports	<div></div>	<div> <div> <div>👁</div> <div>⬇</div> <div>✎</div> </div> <div> <div>⏸</div> <div>✖</div> </div> </div>
338	Case study 8 - desubsidizing air mode	Idle	<div>DONE</div>	Finished. Ready to produce reports	<div></div>	<div> <div> <div>👁</div> <div>⬇</div> <div>✎</div> </div> <div> <div>⏸</div> <div>✖</div> </div> </div>
340	Case study 8 - high speed rail improvement	Idle	<div>DONE</div>	Finished. Ready to produce reports	<div></div>	<div> <div> <div>👁</div> <div>⬇</div> <div>✎</div> </div> <div> <div>⏸</div> <div>✖</div> </div> </div>

Figure 39: Model run window

This window refreshes itself and shows the current step of the calculation. When it has completed the run, which will take about three hours of calculation, the window displays **Finished. Ready to produce reports** in the step description.

4.1.3 Results and Policy Assessment Report

The last step of the simulation is the retrieval of the results, which can be done in two ways:

- In the model run window, click the eye icon in the simulation row (see Figure 39).
- At the top menu, select **Outputs → View outputs of complete runs** (see Figure 40) and then highlight the required run from the dialog and click **Select** (see Figure 41).

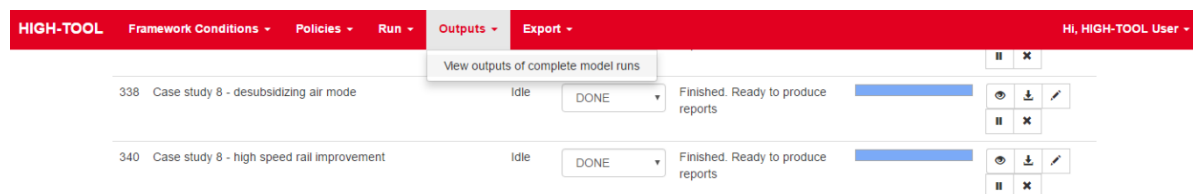


Figure 40: Selecting the outputs interface

Select the output				
Available packages:	Type:	Author:	Date:	
Baseline	Custom	HIGH-TOOL User	20 Oct 2016 15:49:49	
Baseline	Custom	HIGH-TOOL User	30 Nov 2016 18:22:48	
Baseline	Custom	HIGH-TOOL User	30 Nov 2016 23:07:22	
Baseline	Custom	HIGH-TOOL User	1 Dec 2016 03:34:35	
Change 2.5% EU in public and private transport infrastructure investments	Custom	HIGH-TOOL User	1 Dec 2016 14:27:12	

Figure 41: Outputs package selection dialog

In both cases, the outputs window present several tabs with the different results plus a summary of the inputs (see Figure 42).

HIGH-TOOL Framework Conditions Policies Run Outputs Export Hi, HIGH-TOOL User									
Results of a HIGH-TOOL run									
Download Policy Assessment Report									
Simulated Run	Externalities	Costs	Demography	Economy	Passenger Demand	Freight Demand	Vehicle Stock	Safety	Environment
Enhance service quality at ports									
Policy	Start year	Min	Max	User's value	-20%	0	+20%	Unit	Time Map
Average loading time for inland waterways freight	2015	90	105	95				h (100 = baseline)	
Average loading time for sea freight	2015	90	105	95				h (100 = baseline)	
Average unloading for inland waterways freight	2015	90	105	95				h (100 = baseline)	
Average unloading for sea freight	2015	90	105	95				h (100 = baseline)	
Average waiting time for inland waterways freight	2015	85	105	90				h (100 = baseline)	
Average waiting time for sea freight	2015	85	105	90				h (100 = baseline)	
Non-fuel operational cost for bunker or Heavy Fuel Oil (HFO) fuelled ship	2015	80	100	90				eur_veh (100 = baseline)	
Non-fuel operational cost for distillate fuel (marine gas oil (MGO)/marine diesel oil (MDO)) fuelled ship	2015	80	100	90				eur_veh (100 = baseline)	
Non-fuel operational cost for LNG ship	2015	80	100	90				eur_veh (100 = baseline)	
Non-fuel operational cost for Low Sulphur Heavy Fuel Oil (LSHFO) fuelled ship	2015	80	100	90				eur_veh (100 = baseline)	

Figure 42: Model outputs window

The first tab shows the inputs to the simulation, and the other tabs produce different results grouped by category. Click **Download Policy Assessment Report** to obtain an Excel file with all inputs and outputs of the run (for more information, see Section 3.8).

For the scenario calculated, the assessment report file contains graphics in the sheet FRD_graphs as shown in Figure 43 and Figure 44.

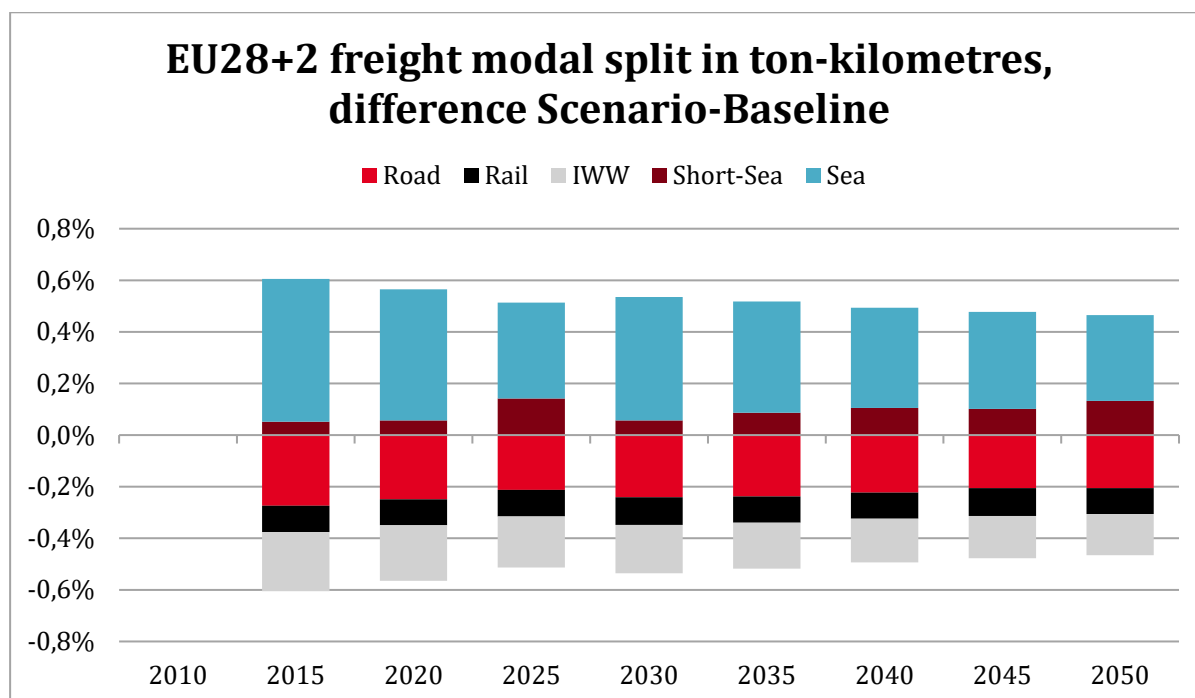


Figure 43: Modal split variation for scenario: *Enhance service quality at ports*

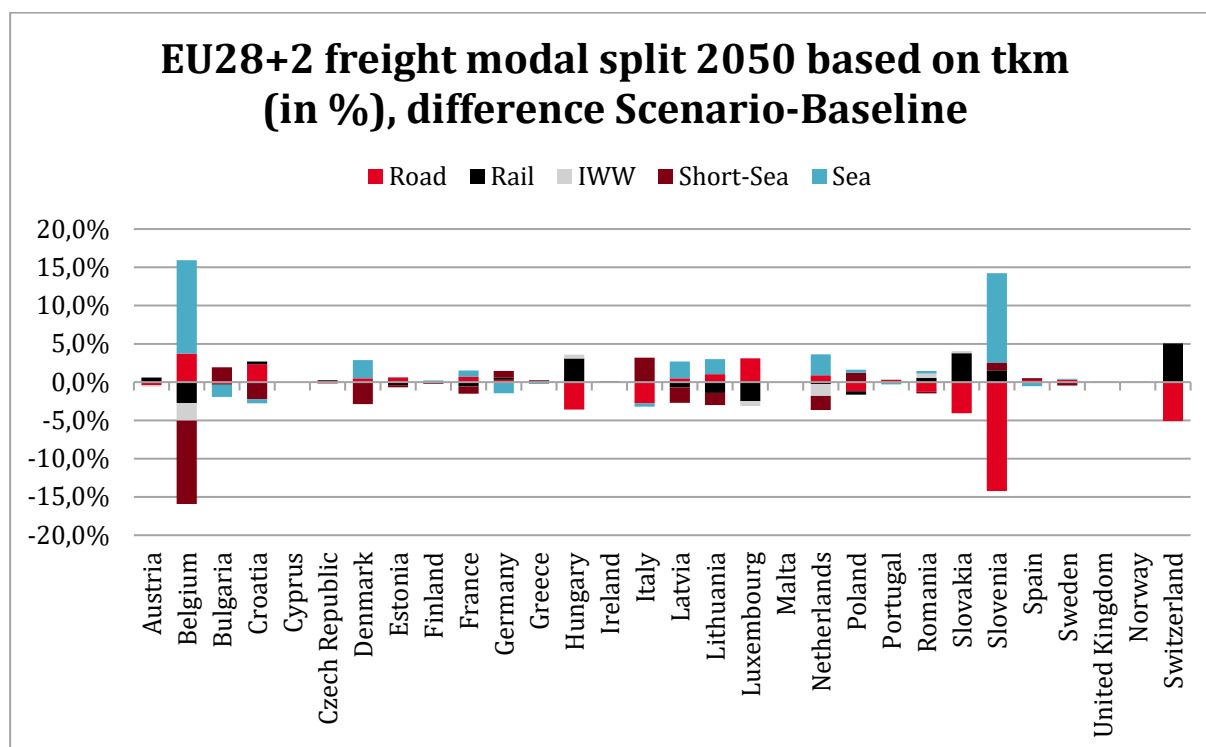


Figure 44: Modal split variation per country in 2050 for scenario: *Enhance service quality at ports*

Thus, the simulated policy leads to a general shift of 0.6% in traffic from inland modes to maritime transport, but the impact differs considerably per country. This scenario clearly favours Slovenia, which increases the maritime transport by 13%, and in turn boosts rail transport in nearby countries, such as Switzerland, Slovakia and Hungary.

4.2 Example 2: Customised Policy Package

Policy question: *What would be the effect of improving the Magistrale rail corridor for passenger transport?*

As HIGH-TOOL does not have a predefined transport policy measure to respond to this question, a customised scenario has to be constructed. This will require use of the **expert mode** to make changes to the network level using the **hyper-network interface**.

4.2.1 Introducing the Policy Package

The first step is the preparation of a policy package without the support of predefined policy levers. To make these changes, select **Policies** → **Define a Customised Policy package** as shown in Figure 45. The list of all available policy levers classified per module can be explored using the tabs in the second line of the window (see Figure 46).

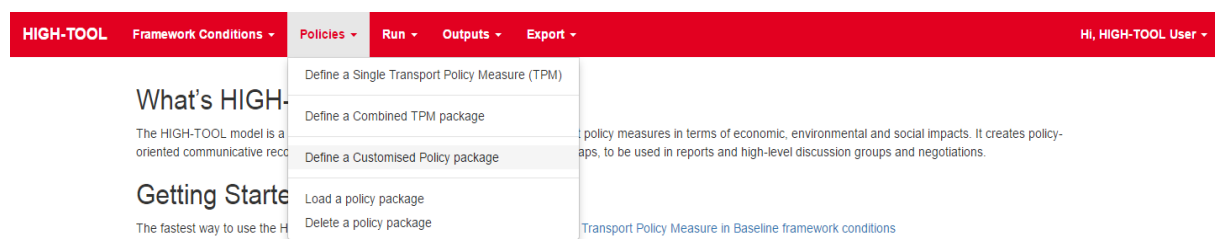


Figure 45: Accessing the customised policy package menu

Define a custom Transport Policy Measure (TPM)

« DEM Module ECR Module **VES Module** PAD Module FRD Module ENV Module SAF Module Policies without levers »

Save as a new package

VES Module										
Use	Variable	Start year	Select value	-20%	0	+20%	Unit	Reset	Time	Map
<input type="checkbox"/>	Additional fuel tax for articulated HDTs: 14-20t	2015	80	<input type="range"/>	125	<input type="text" value="100"/>	eur_tkm (100 = baseline)	<input type="button" value="↺"/>	<input type="button" value="↻"/>	<input type="button" value="📍"/>
<input type="checkbox"/>	Additional fuel tax for articulated HDTs: 20-28t	2015	80	<input type="range"/>	125	<input type="text" value="100"/>	eur_tkm (100 = baseline)	<input type="button" value="↺"/>	<input type="button" value="↻"/>	<input type="button" value="📍"/>
<input type="checkbox"/>	Additional fuel tax for articulated HDTs: 28-34t	2015	80	<input type="range"/>	125	<input type="text" value="100"/>	eur_tkm (100 = baseline)	<input type="button" value="↺"/>	<input type="button" value="↻"/>	<input type="button" value="📍"/>
<input type="checkbox"/>	Additional fuel tax for articulated	2015	80	<input type="range"/>	125	<input type="text" value="100"/>	eur_tkm	<input type="button" value="↺"/>	<input type="button" value="↻"/>	<input type="button" value="📍"/>

Figure 46: The customised policy package interface

In the simulation, click **Save as a new package** to access a dialog to input information (see Figure 47):

- Filename: a short name (one or several words) to be shown in the list of saved policy packages.
- Headline: summarising the policy package to be shown in the scenario run manager.
- Abstract: a brief text describing the policy and the model inputs. This can be a copy-paste from a document.

Update package metadata

Filename:

Headline:

Abstract:

File Edit View Format

↶ ↷ Formats B I ☰ ☷ ☰ ☷ ☰ ☷ ☰ ☷

new package

p

Figure 47: Dialog for a customised policy package with title, headline abstract

The title and the headline for this example are ***Improvement of Magistrale rail corridor***. When all the required information has been entered, click **Save** to close the dialog. The new empty policy package is ready for the next step.

4.2.2 Preparing the Data Stock

The second step of the simulation is to launch the first part of the simulation run, which comprises copying the data stock so that modifications can be made using the hyper-network editor. This has to be done to create a copy of the data stock that includes any policy lever we want to simulate, on which we can edit the hyper-network. Use the top menu and navigate to **Run → Run a policy package** to open a dialog with all the saved policy packages (see Figure 48).

Select the element to add to the run queue				
Available packages:	Type:	Author:	Date:	
Baseline	Custom	HIGH-TOOL User	12 May 2016 13:57:24	
Magistrale	Custom	Guest	1 Jul 2016 21:13:52	
Infrastructure charge for heavy-duty vehicles	Single TPM	Guest	2 Jul 2016 16:12:05	
CO2 standards	Custom	Guest	2 Jul 2016 21:29:52	
Improvement of rail freight	Custom	Guest	4 Jul 2016 13:01:30	
Alcolocks	Custom	Guest	4 Jul 2016 17:42:36	
Accelerate TEN-T	Single TPM	Guest	5 Jul 2016 11:50:45	

Figure 48: Policy package selector

Scroll to the newly created policy package ***Improvement of Magistrale rail corridor***. Click the row to highlight in grey, and select **Expert mode** at the bottom left of the dialog. Click **Select** at the bottom right of the dialog to close the dialog and access the model run window. The policy package is at the end of the run list (see Figure 49) with the row highlighted in green, indicating the system is preparing the data stock for the simulation.

View and manage your model runs

Id	Alias	Status	Step Id	Step Description	Run progress	Actions
273	Baseline	Idle	<div>DONE</div>	Finished. Ready to produce reports	<div></div>	<div> <div> <div></div> <div></div> <div></div> </div> <div> <div></div> <div></div> <div></div> </div> </div>
333	Baseline	Idle	<div>DONE</div>	Finished. Ready to produce reports	<div></div>	<div> <div> <div></div> <div></div> <div></div> </div> <div> <div></div> <div></div> <div></div> </div> </div>
334	Baseline	Idle	<div>DONE</div>	Finished. Ready to produce reports	<div></div>	<div> <div> <div></div> <div></div> <div></div> </div> <div> <div></div> <div></div> <div></div> </div> </div>
335	Baseline	Idle	<div>DONE</div>	Finished. Ready to produce reports	<div></div>	<div> <div> <div></div> <div></div> <div></div> </div> <div> <div></div> <div></div> <div></div> </div> </div>
336	Change 2.5% EU in public and private transport infrastructure investments	Idle	<div>DONE</div>	Finished. Ready to produce reports	<div></div>	<div> <div> <div></div> <div></div> <div></div> </div> <div> <div></div> <div></div> <div></div> </div> </div>
337	Baseline	Idle	<div>DONE</div>	Finished. Ready to produce reports	<div></div>	<div> <div> <div></div> <div></div> <div></div> </div> <div> <div></div> <div></div> <div></div> </div> </div>
338	Case study 8 - desubsidizing air mode	Idle	<div>DONE</div>	Finished. Ready to produce reports	<div></div>	<div> <div> <div></div> <div></div> <div></div> </div> <div> <div></div> <div></div> <div></div> </div> </div>
340	Case study 8 - high speed rail improvement	Idle	<div>DONE</div>	Finished. Ready to produce reports	<div></div>	<div> <div> <div></div> <div></div> <div></div> </div> <div> <div></div> <div></div> <div></div> </div> </div>

Figure 49: Model run window

When the data stock is ready, which will take about ten minutes, the run displays **Waiting for user updates** in the step description. Select the pencil icon to enter the *expert mode*.

4.2.3 Editing the Hyper-network

In the *expert mode* (see Figure 50), enter the *hyper-network editor* for rail by selecting the tab **Edit Rail Network**.

Expert mode for run Improvement of Magistrale rail corridor (349)

EXPERTMODE - Paused

Edit tables

Edit Road Network

Edit Rail Network

Option:

Set a upload queue

Go to Run definition

Continue

CAUTION: A table modified outside Expert Mode without having paused the run may result in undefined behaviour or compromise data consistency.

Upload queue:

No files to upload

Search options

Id

Search by variable Id

Table

Search by table Id

Description

Search by description

All

Innits

Outputs

Parameters

Figure 50: Expert mode interface

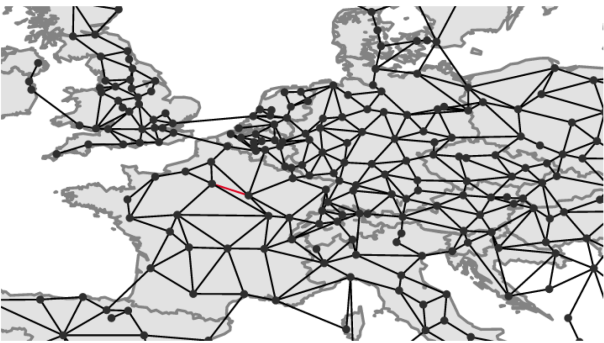
In the rail network interface, modify the edges that represent rail links. In this example, select those related to the Magistrale corridor connecting Paris to Vienna and Bratislava.

Click on a desired edge to display a menu on the right side of the screen showing the parameters that can be changed (see Figure 51). For example in this simulation, the time weight factor is set to 0.9 for all years from 2030 onwards. This means travel time on the rail link is 10% less than the baseline configuration. The process is repeated for all edges until the whole corridor is modified, and then click **Save** (see Figure 52).

HIGH-TOOL
Framework Conditions
Policies
Run
Outputs
Export
Hi, HIGH-TOOL User

Expert mode for run Improvement of Magistrale rail corridor (349)
EXPERTMODE - Paused

Edit tables
Edit Road Network
Edit Rail Network



Actions
Save
Reset all
Reset selected

Selected Edge (2010 data)

Source: Troyes (1120201)
Target: Paris (1120100)

Hypemet link time for passenger transport: 71.9 min
Hypemet link distance for passenger transport: 170.4 km

Year	Hypemet link time weight for passenger transport	Hypemet link distance weight for passenger transport
2010	1	1
2015	1	1
2020	1	1
2025	1	1
2030	0.9	1
2035	0.9	1
2040	0.9	1
2045	0.9	1
2050	0.9	1

Figure 51: Editing the rail hyper-network



Figure 52: The entire Magistrale corridor modified

When all inputs to the model have been made, start the calculations by selecting **Edit tables** and clicking **Continue** (see Figure 50). The interface then displays the model run window. The policy package runs at the end of the list of runs (see Figure 53) with the row highlighted in green, indicating the system is working on the simulation.

View and manage your model runs

Id	Alias	Status	Step Id	Step Description	Run progress	Actions
273	Baseline	Idle	DONE	Finished. Ready to produce reports	<div></div>	<div> <div>👁️ ⬇️ ✎</div> <div>⏸️ ✖️</div> </div>
333	Baseline	Idle	DONE	Finished. Ready to produce reports	<div></div>	<div> <div>👁️ ⬇️ ✎</div> <div>⏸️ ✖️</div> </div>
334	Baseline	Idle	DONE	Finished. Ready to produce reports	<div></div>	<div> <div>👁️ ⬇️ ✎</div> <div>⏸️ ✖️</div> </div>
335	Baseline	Idle	DONE	Finished. Ready to produce reports	<div></div>	<div> <div>👁️ ⬇️ ✎</div> <div>⏸️ ✖️</div> </div>
336	Change 2.5% EU in public and private transport infrastructure investments	Idle	DONE	Finished. Ready to produce reports	<div></div>	<div> <div>👁️ ⬇️ ✎</div> <div>⏸️ ✖️</div> </div>
337	Baseline	Idle	DONE	Finished. Ready to produce reports	<div></div>	<div> <div>👁️ ⬇️ ✎</div> <div>⏸️ ✖️</div> </div>

Figure 53: Model run window

4.2.4 Results and Policy Assessment Report

The last step of the simulation is retrieval of the results, which can be done in two ways:

- In the model run window, click the eye icon in the row of our simulation (see Figure 53).

- In the top menu, select **Outputs** → **View outputs of complete runs** (see Figure 54) and then highlight the desired run in the dialog and click **Select** (see Figure 55).

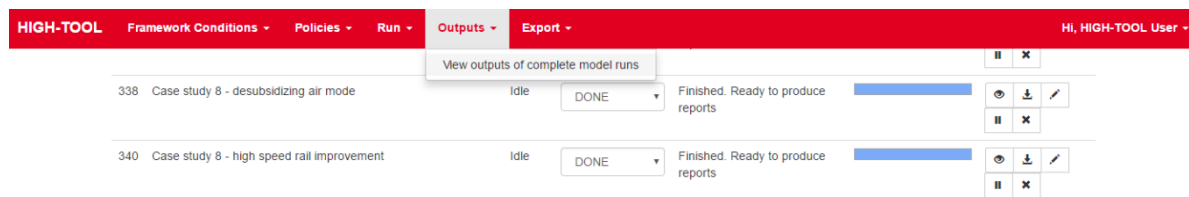


Figure 54: Selecting the outputs interface

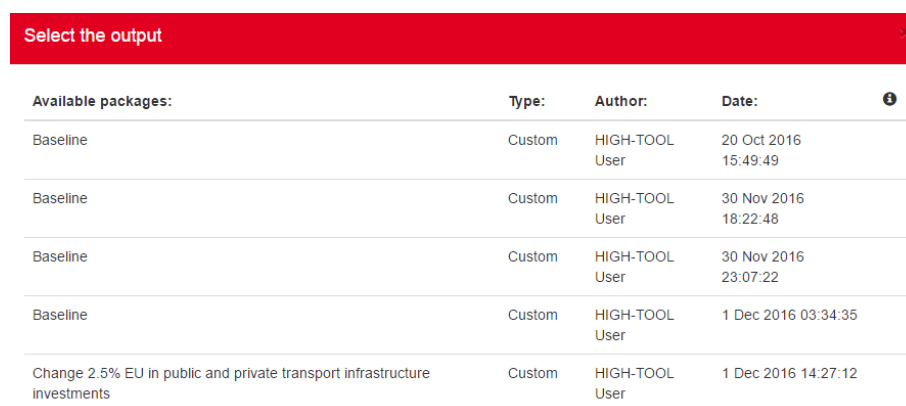


Figure 55: Outputs package selection dialog

In both cases, the outputs window displays several tabs with different results plus a summary of the inputs (see Figure 56).

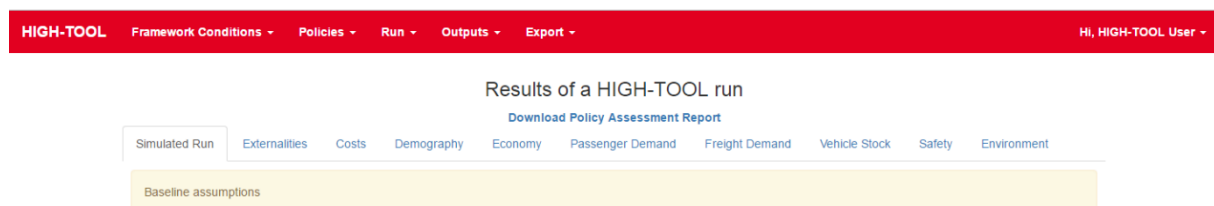


Figure 56: Model outputs window

The first tab displays the simulation inputs. This simulation displays **baseline assumptions** because no policy lever was selected. The **expert mode** modifications, such as the rail network editing, are not reflected here, but should be clearly stated in the policy package abstract (see Figure 47). The other tabs display different results grouped by category.

Click **Download Policy Assessment Report** to obtain an excel file with all inputs and outputs of the run (For more details, see Section 3.8). The assessment report file for the scenario calculated contains graphics in the sheet PAD_graphs, showing the following:

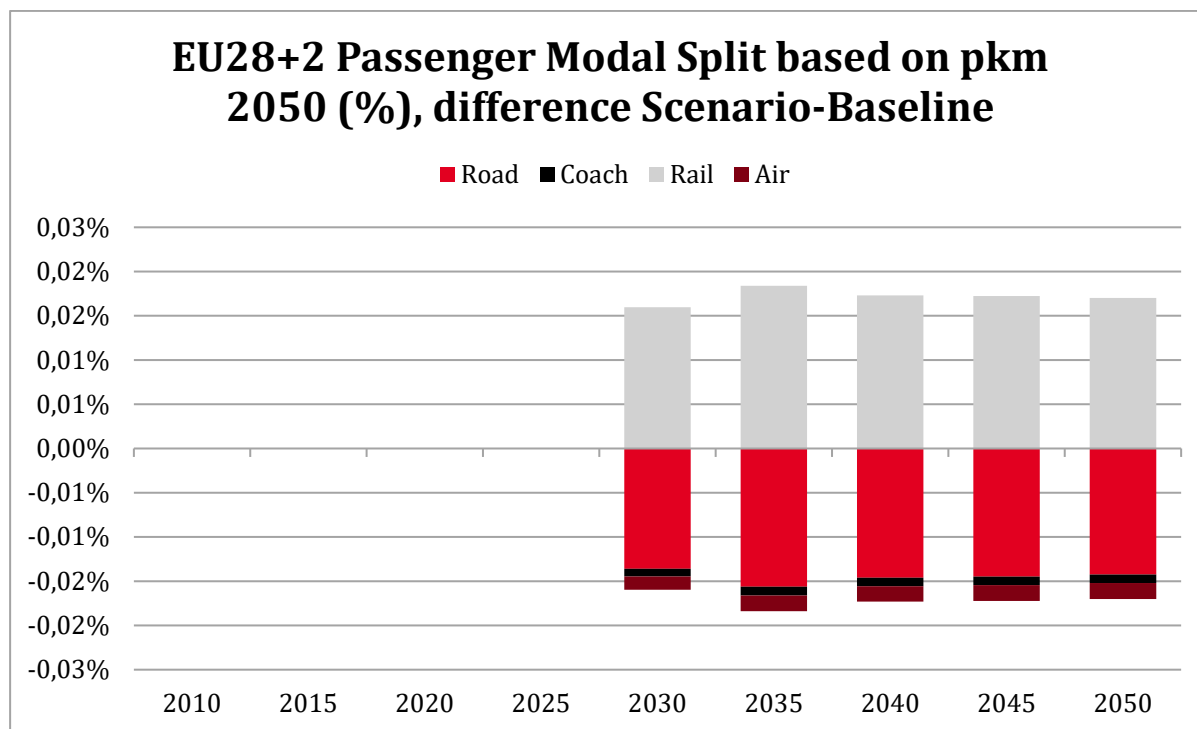


Figure 57: Modal split variation for scenario: Improvement of Magistrale rail corridor

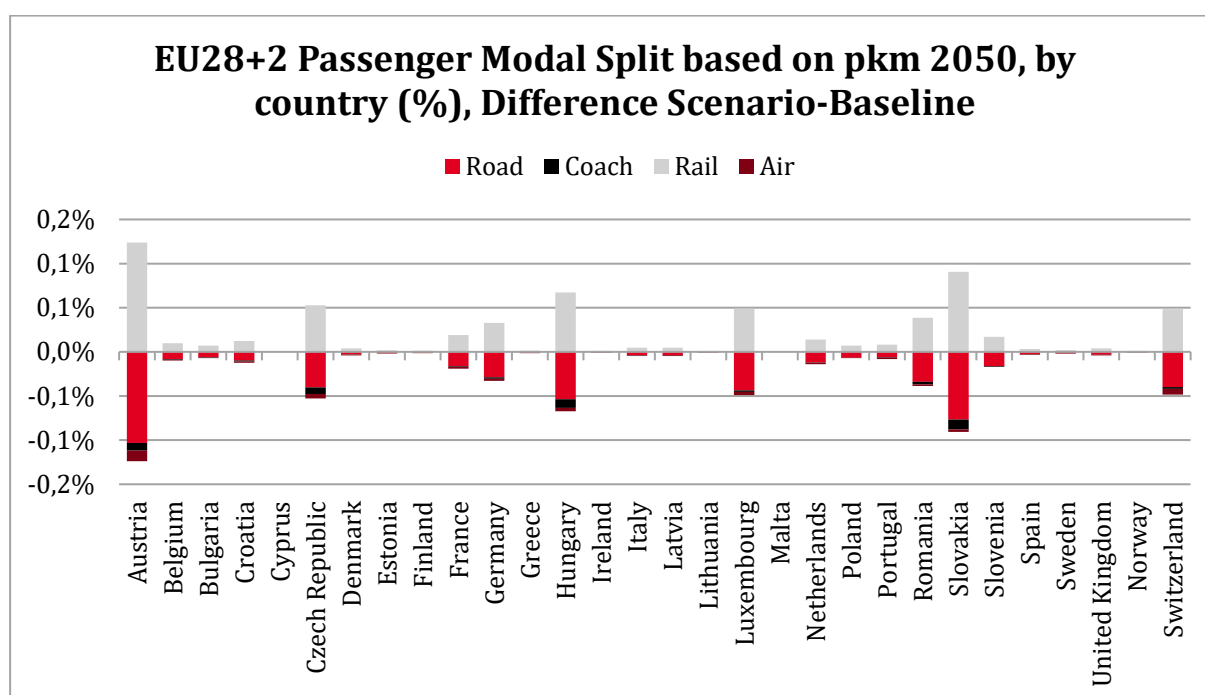


Figure 58: Modal split variation per country in 2050 for scenario: Improvement of Magistrale rail corridor

Thus, the simulated policy results in a general shift of 0.02% of traffic from car, coach and air to rail transport, but the impact differs considerably depending on the country. The effect is most pronounced in countries along or adjacent to the modified corridor, such as Austria, Slovakia, Hungary and Switzerland. The relative effect in France and Germany is much smaller because this corridor represents a small proportion of the total rail traffic.

5 References

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Annex

HIGH-TOOL User Guide

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Preface

The Annex, prepared by Efrain Larrea and Cristian Lorenzo Martínez (Mcrit), presents the specific instructions to install and run the stand-alone version of HIGH-TOOL in a desktop computer. This is a procedure requiring technical knowledge. Thus we recommend the IT administrator to install the model.

1 Hardware Requirements

The model needs a minimum amount of RAM to be able to run and requires a very fast disk, as I/O is the main bottleneck.

Requirements:

- Minimum 32 GB RAM
- Processor Intel Core i5 at least (with motherboard able to handle PCIe disks)
- SSD hard disk drive with at least 256 GB. Ideally with PCIe interface instead of SATA.

2 Software Requirements

The stand-alone version of the HIGH-TOOL targets the following platform:

- Windows 7 Professional 64 bits or newer.
- Oracle Java v8 RTE (Run Time Environment).
- Postgresql with the PostGIS extension.

3 Instructions to Install the Third Party Software

3.1 Oracle Java v8 RTE

The HIGH-TOOL interface needs a Java v8 compatible RTE to:

- Compile the Excel version of the Policy Report Assessment.
- Run the HIGH-TOOL modules.

To install the Java v8 SDK,

- Download the Windows 64 bits .exe executable from:
<http://www.oracle.com/technetwork/java/javase/downloads/jdk8-downloads-2133151.html>
- Run, with administrator privileges, the downloaded executable.
- Follow the screen instructions.

The installable should add the Java Path to the system variables. Please check it by doing the following:

- Launch a Power Shell.
- Write
java -version
- The shell should report the Java RTE installed with a message similar to this one:
Java version "1.8.0_66"
Java(TM) SE Runtime Environment (build 1.8.0_66-b17)
Java HotSpot(TM) 64-Bit Server VM (build 25.66-b17)

The reported version may vary, but you should ensure that the version is, at least, 1.8.xxx.

If the java path wasn't exported, follow these instructions:

- Find the installation path of Java SDK. It should be something similar to *C:\Program Files\Java\jdk1.8.0_92*
- Right click on "My computer" and select properties
- Click the **Advanced** tab
- Click the **Environment variables** button
- Under **System variables** click **New**
- Enter the variable name as **JAVA_HOME**

- Enter the variable value as the installation path for the Java Development Kit
- Click **OK** and **Apply Changes**.

3.2 Postgresql + PostGIS

To install Postgresql:

- Download the latest package from <http://www.enterprisedb.com/products-services-training/pgdownload#windows> Choose the one you need according to the OS and between 32/64-bit.
- Run, with administrator privileges, the downloaded executable.
- Before exiting the setup wizard tick on the box to select Stack Builder option.
- On the Stack Builder window select “PostgreSQL X.X...” from the dropdown list and click *next*.
- From the available options select “Spatial extensions” and tick on “PostGIS...”, choosing the appropriate version 32/64-bit. Select next and install the extension.

3.3 Activating PostGIS extension for the Database

- Open pgAdmin III, the GUI that comes bundled in the Postgresql package.
- Connect to the local database.
- Right click on the name of the local database and select *Query Tool* from the menu.
- Enter **CREATE EXTENSION postgis;** into the window.
- Run command by using the **F5** key, or by clicking on the *Lightning symbol*.

3.4 Instructions to Install the HIGH-TOOL Data Stock

- Open pgAdmin III, the GUI that comes bundled in the Postgresql package.
- Connect to the local database.
- Right click on the name of the local database and select *Restore* from the menu.
- Select the file containing the HIGH-TOOL data stock.
- Choose the appropriate role from the list.
- In the options tab #1 check the box *Do not save owner*.
- Click on Restore and wait until the process is finished (might take at least 30 minutes).

4 Installing the HIGH-TOOL Interface

The HIGH-TOOL interface is delivered in two flavours:

- A server side instance using Node v4
- A Windows 7 64 bits installable.

Windows 7 64-bit installable

Download the .exe installable from the origin HIGH-TOOL FTP server: "HIGH-TOOL Setup.exe".

The installable is not signed and Windows will ask three times for administrator privileges:

- To open the .exe
- To install the interface
- The first time it runs to allow the interface to connect to the Internet.

The installation wizard is very simple and will delete any previous versions and install the HIGH-TOOL interface in the 64-bit programmes' folder. Usually:

C:\Users\XXX\AppData\Local\high\app-Y.Y.Y

Where XXX is the username of the Windows account and Y.Y.Y refers to the version number of the stand-alone programme.

The installed programme does not use any packaging or code obfuscation technique. This means that all the JavaScript files are exposed and can be modified to change the programme behaviour if the user desires to. The remarkable folders that an advanced user should be aware of, are

C:\Users\XXX\AppData\Local\high\app-Y.Y.Y\resources\app

- *.tmp*: Contains the file *localDiskDB.db*. This file is a json with all the interface data (users, TPMs, runs, etc.). Should be backed-up to restore the
- *.tmp\public*: This folder contains a copy of the UI. This folder is updated every time that programme is launched: ALL MODIFICATION HERE WILL BE LOST.
- *java_modules*: Contains the HIGH-TOOL Java modules, configuration files, logs and dependencies (Excel files, csv with default data, etc.).
- *assets*: This folder contains the HTML client of the HIGH-TOOL interface. This folder is copied to *.tmp\public* in every start up.
- *config*
 - *connections.js*: This exports a JavaScript object with the credential to connect to the Data Stock.

- *jwt-variables.js*: This file exports the secret key used to sign the token used to authenticate and authorize the users. If the instance of the HIGH-TOOL interface will be exposed to insecure networks, the key MUST be changed or an attacker can create tokens with administrator privileges or impersonate any user using this key.
- *ooo-templates/HTPolicyReportTemplate.xlsx*: This Excel file is the template of the Policy Assessment Reports.

5 Launching the Interface for the First Time

Upon launching the interface it will check and download the latest version for each module from the HIGH-TOOL server, as shown on Figure A1.

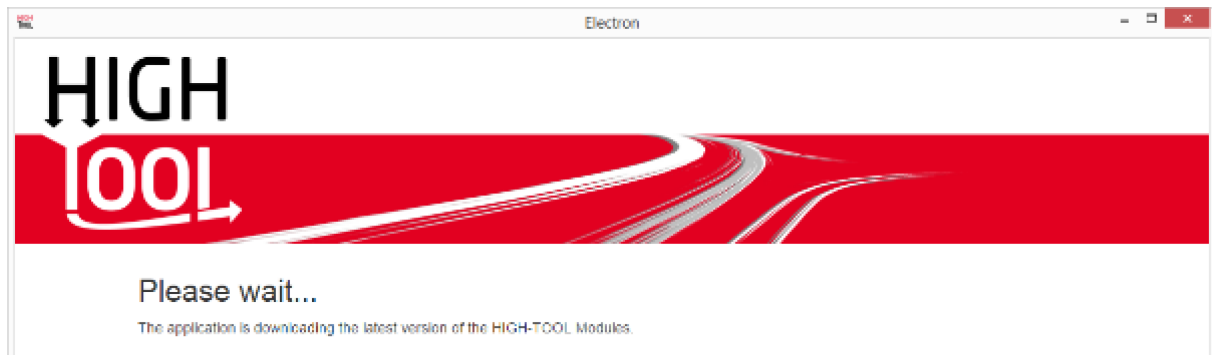


Figure A1: Stand-alone version downloads the HIGH-TOOL Modules

In every start-up, the interface tries to connect to the Data Stock. If the Data Stock is not found or the credentials are not correctly set, which is likely to happen during the first time, the interface will launch a configuration utility. This utility allows to:

- Set the credentials to connect to the Data Stock.
- Set specific module options. In particular, it exposes the option to use Excel or Open/LibreOffice. See the chapter “SAF specific” to understand those options.

Once you have changed the credentials and the module specifics to match your environment, switch to the **Actions** tab and press the button **Save**. The **Save** button will trigger a routine to modify all the involved interface and module files at once: you don't need to modify any file by your own.

After saving your configuration, press the **Reload** button to try again to connect to the Data Stock. If the interface still fails to connect to the Data Stock, the configuration utility will be launched again.

The base installation has a default administrator user:

- e-mail: high-tool@high-tool.eu
- password: high-tool

This user must be changed when using the stand-alone version if the interface will be exposed to insecure networks.

6 Debugging the Stand-alone User Interface

The HIGH-TOOL stand-alone user interface doesn't pipe stdout or stderr to any file. To see the console outputs of the programme, you can launch it in a Power shell running the programme

```
C:\Users\XXX\AppData\Local\high\app-Y.Y.Y
```

To save this output to a file, you can redirect the stdout using the > operator:

```
C:\Users\XXX\AppData\Local\high\app-Y.Y.Y > output.txt
```

The produced output.txt will have all the console outputs of the programme.

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