

LOCOMOTION

Shared database and Open DBMS management manual (database system)

WP 9, Task 9.3, D.9.3

30 November 2023

**LOW-CARBON SOCIETY: AN ENHANCED MODELLING TOOL FOR
THE TRANSITION TO SUSTAINABILITY (LOCOMOTION)**

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ABBREVIATIONS AND ACRONYMS

Acronym	Description
DB	Database
DBMS	Database Management System
DQ	Data quality
DQG	Data Quality Goals
ESMS	Euro SDMX Metadata Structure
EU	European Union
FAIR	Findable, Accessible, Interoperable and Reusable
GD	Green Deal
GG	Green Growth
GDPpc	Gross Domestic Product per capita
GUI	Graphical User Interface
HTML	HyperText Markup Language
PG	Post-Growth

1. DATABASE FOR MODELLING GROUPS

INTRODUCTION – OVERVIEW OF THE AIMS AND ASPECTS OF THE DATABASE

The shared database and open database management system developed in the LOCOMOTION project consists of three different parts:

- The first part of the database, which is called Data Dictionary (Section 1.1 Data Dictionary), includes information on the Symbols developed within the project (variables, historical data, constants, parameters, scenario parameters, etc.) and used in the models and information related to their metadata, as well as acronyms, semantic rules, etc. A specific protocol has been defined for the Data Dictionary in order to validate modifications based on the authorised roles of users. The purpose of the Data Dictionary is to enhance the transparency of the model by disclosing all the Symbols and data sources used.
- The second and third part of the database of the narrative description of simulated scenarios and the main output variables of WILIAM, which is called the WILIAM Database of selected simulated scenarios and results (Section **Error! Reference source not found. Error! Reference source not found.**), include information on the narrative description of selected storylines and selected simulated scenarios and the necessary details to access the inputs used for these scenarios, as well as the future projections of the main output variables of the model for selected simulated scenarios. The purpose of the WILIAM Database of selected simulated scenarios and results is to be used as an instrument for dissemination of the results of WILIAM.

The Data Dictionary and the WILIAM Database of selected simulated scenarios and results are available under a CC BY license. This license lets others distribute, remix, adapt, and build upon your work, even commercially, as long as they credit you for the original creation. This is the most accommodating of licenses offered and it is recommended for maximum dissemination and use of licensed materials (Creative Commons, 2023).

1.1. DATA DICTIONARY

1.1.1. ACCESS TO THE DATA DICTIONARY AND MAIN PAGE

The Data Dictionary consists of three parts:

- 1) The first part is the relational database, where all the actual data are stored.
- 2) The second part is the middle layer, which is used for all interaction with the database (Create, Read, Update, Delete).
- 3) The third part is the front end, which helps the user to interact with the database through a web application.

The web application is currently hosted in CRES with URL: http://www.cres.gr/LOCOMOTION_client and it is also available in the LOCOMOTION project website with URL: <https://www.locomotion-h2020.eu/locomotion-models/database/>.

In the main page, the user has two options in order to proceed:

- 1) The first is to proceed to the Public View as a non-registered user. This option is available for external users to the LOCOMOTION project in order to provide them with enough information with respect to the WILIAM model and enhance the transparency of the model by disclosing information on all the Symbols and data sources used.
- 2) The second is to Log in with their credentials. If they choose to Log in, the system will recognize them as a registered user with a certain role and redirect them to the relative user main page. This option is only available for the LOCOMOTION modelling groups in order to allow the creation, maintenance and support of the modelling groups in the use of data during the development of the WILIAM model.

The different kinds of users and user roles are created in order to ensure the security and integrity of the Data Dictionary.

USER REGISTRATION

Users are created by a General Supervisor. After the creation of a user, the system produces a random password for them and sends an email containing the password to the e-mail address declared during the creation of the user. The new user will be asked to change this password the first time they log in.

1.1.2. TYPES OF USERS IN THE DATA DICTIONARY

The types of users and user roles provided in the Data Dictionary are presented briefly below:

- Public View is available for non-registered users.
- Access to some of the data and to certain features of the web application is allowed only to registered users.
- A registered user can have one or more roles:
 - General Supervisor
 - Module Supervisor
 - Module Programmer
- A user can be a Module Supervisor to a module and Module Programmer to other modules.
- A module can have only one supervisor.
- The General Supervisor's role is not associated with any module or modules in particular, but with all modules.
- There is a special Service Authenticator role, which allows users to inject automatically multiple Symbols at once or obtain information for multiple Symbols.

1.1.3. MAIN ENTITIES OF THE DATA DICTIONARY

The main entities included in the Data Dictionary are presented below.

1.1.3.1. MODULES

The WILIAM model consists of different modules, as seen in Figure 1. Each Symbol has a main module and it can be used in more than one modules.

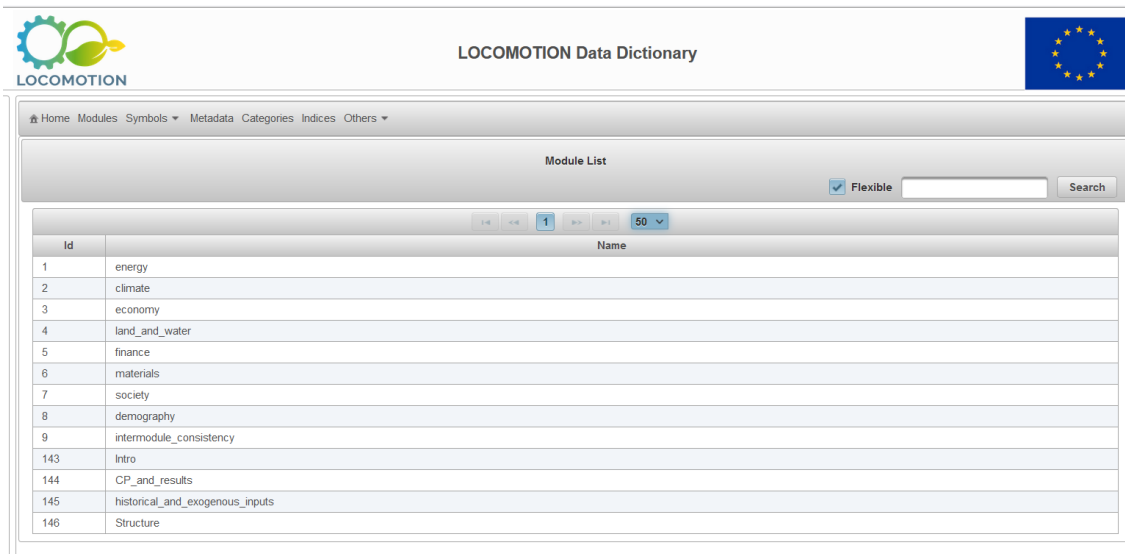


Figure 1. Module List main page

1.1.3.2. SYMBOLS

A large set of Symbols (variables, parameters, constants, etc.) are introduced in the WILIAM model. For a Symbol to be ready to be used, it must first be validated. A detailed description of the features of the Symbols' section is provided by type of user in subsequent sections 1.1.4.2 Module Programmer, 1.1.4.3 Module Supervisor and 1.1.4.4 General Supervisor.

1.1.3.3. METADATA

The relationship between Symbols and Metadata is a one-to-many relationship, while metadata records can exist without being associated with a Symbol and vice versa. A Symbol can only be connected to one metadata record and a metadata record can belong to several Symbols. Metadata can be uploaded in the database without having information on which Symbol (or Symbols) they are associated with. This can be done mainly by reading the commonly shared "Metadata template" excel file. This was implemented, in order to facilitate users who have already uploaded metadata in the "Metadata template" excel file, as under this approach users are not obliged to duplicate efforts and insert the same information directly in the database as well.

1.1.3.4. CATEGORIES

Categories are implemented in a tree structure of a maximum of three levels (this means that a category can have up to two sub-categories). A Symbol can belong to only one category (or sub-category). The main page of categories can be seen in Figure 2.

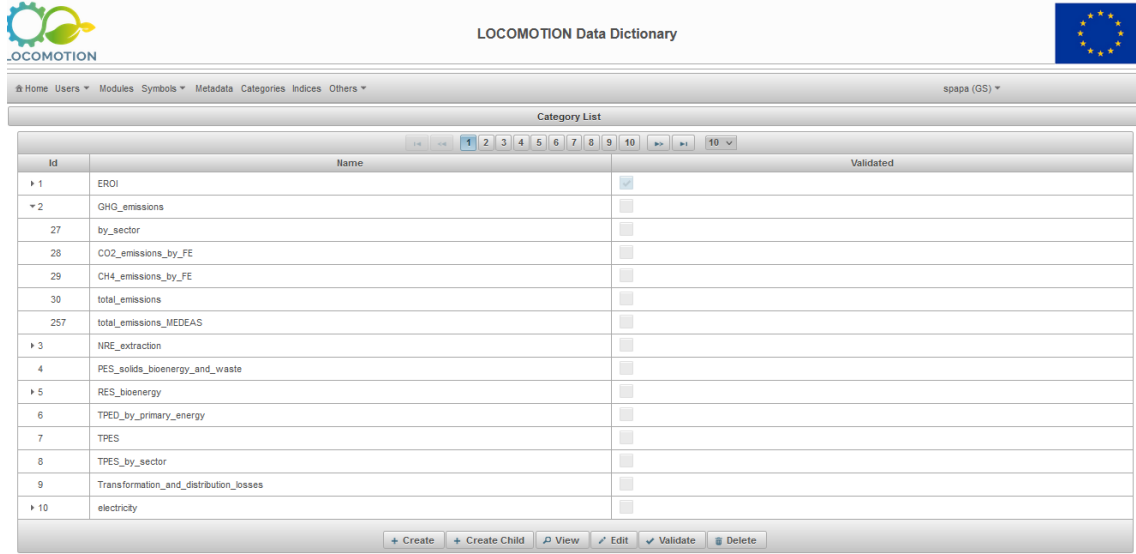


Figure 2. Category List main page

1.1.3.5. INDICES

Some Symbols are declared as indexed and are therefore associated with Indices. An Index is created along with its value or values. Users can view existing Indices. Indices are shown in two different tabs, depending on whether they are validated or not. Users can filter indices with their name, doing a flexible or not search. The main page of the Index list can be seen in in Figure 3.

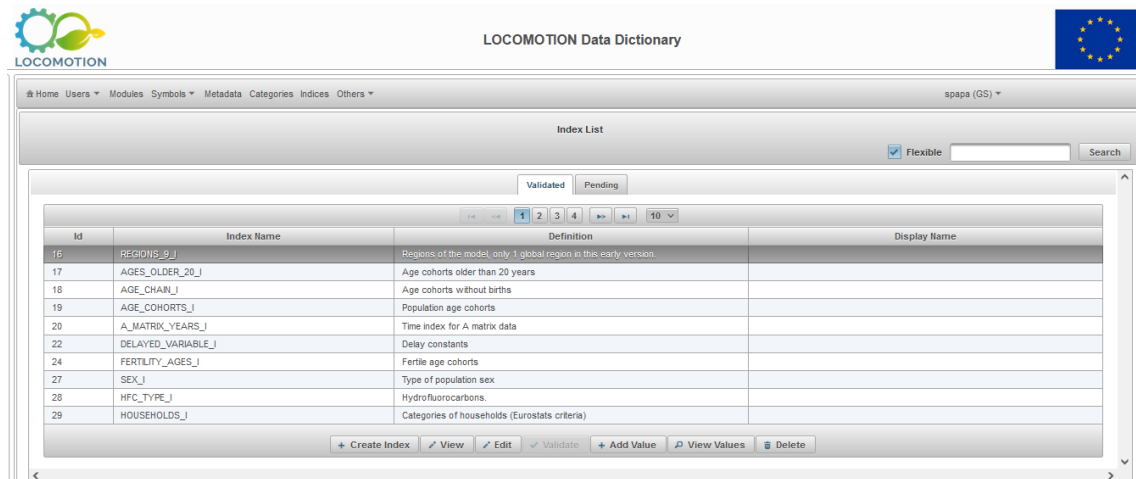


Figure 3. Index List main page

1.1.3.6. OTHER ENTITIES

Other entities include:

- **Acronyms, Adjectives, Semantic Rules, Unit Systems:** These entities are created to facilitate the tasks of modelling and programming and the understanding of the project by external users, i.e., people outside of the LOCOMOTION project.

- **Project Type of Values, Programming Language Symbol Types:** Each Symbol is characterized by a type that its value has in the project (variable, constant, time-series data etc.) and this type is matched with a corresponding programming language (Vensim® for LOCOMOTION) Symbol type.
- **Roles:** This entity includes the roles of users.
- **Sections:** This entity includes the sections of the modules.

1.1.4. FUNCTIONALITIES OF THE DATA DICTIONARY BY TYPE OF USER

Depending on the type of user, a user can navigate through the Data Dictionary web application as described below. The aspects for each user role and the functionalities of the Data Dictionary are presented starting from users who have access to less functionalities, followed by the additional aspects and functionalities featured.

1.1.4.1. NON-REGISTERED USER

Public View of the Data Dictionary is available for non-registered users. This option is available for external users to the LOCOMOTION project in order to provide them with enough information with respect to the WILLIAM model and enhance the transparency of the model by disclosing information on all the Symbols and data sources used. Non-registered users can view almost all the information in the Data Dictionary without any personal information about the registered users of the system and without the permission to add or modify any entity object. A non-registered user can navigate through the Data Dictionary web application as described below.

1.1.4.1.1. MAIN PAGE

The main page of the Data Dictionary, the available Symbol actions and other options for a non-registered user are presented in Figure 4, Figure 5 and Figure 6 Figure 18.



Figure 4. Main page of the LOCOMOTION Data Dictionary for non-registered users

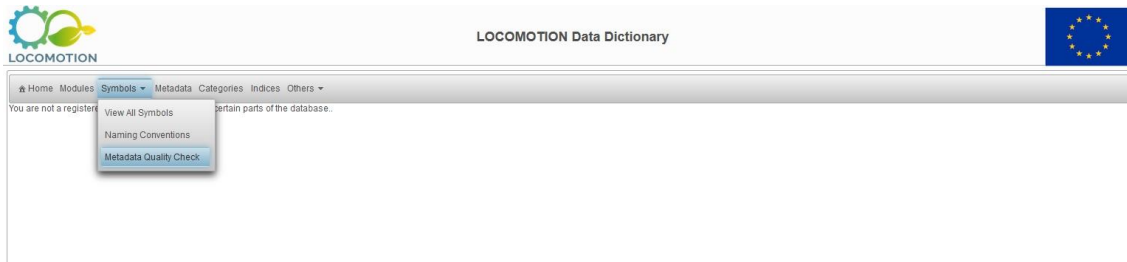


Figure 5. Symbol actions available for non-registered users

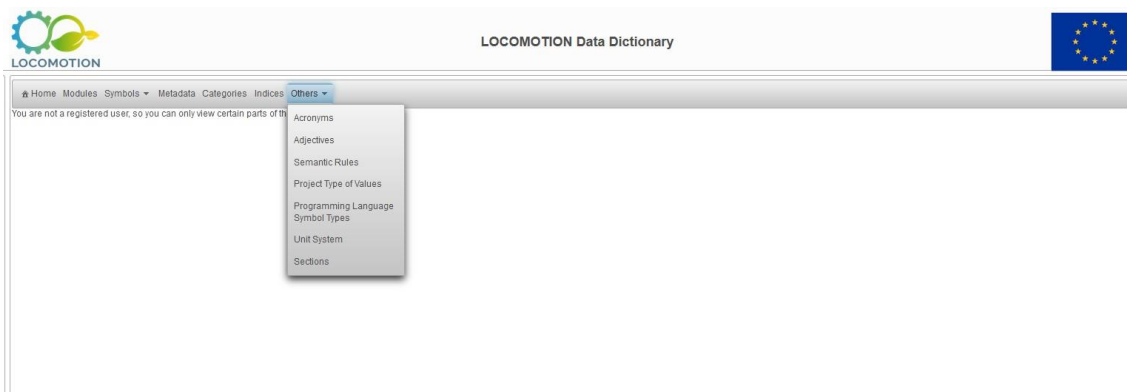


Figure 6. Other options available for non-registered users

1.1.4.1.2. SYMBOLS

VIEW SYMBOLS

The user can view and obtain information, such as Name, Definition, Category, Main module and Metadata, for all the validated Symbols associated with the WILIAM model, as it can be seen in Figure 7. The user can view all the Symbols of the WILIAM model through:

Menu/ Symbols/ View All Symbols

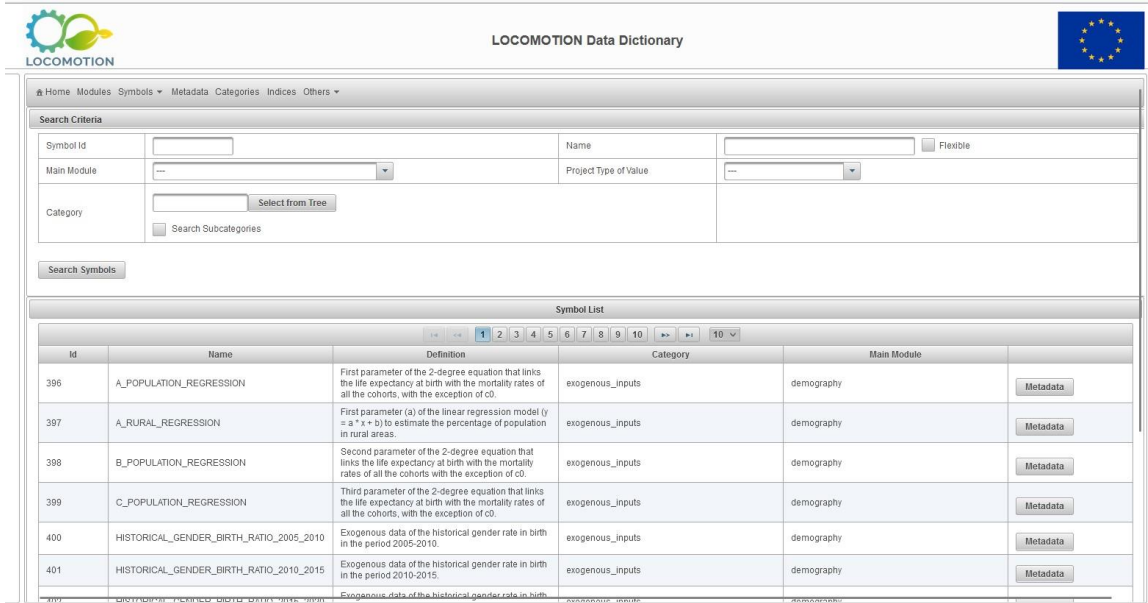


Figure 7. View All Symbols page

In this page the user has several options:

Search for a Symbol

The user can use **search criteria to filter the Symbol**. These criteria include the Symbol ID, the Symbol name, the main module of the Symbol, the Symbol category and the Project Type of Value of the Symbol. In case the search is performed based on the Symbol Name, the search can be flexible or not, i.e., the Symbol Name must match exactly or partially the search text. An example of a flexible Symbol Name search is presented in Figure 8.

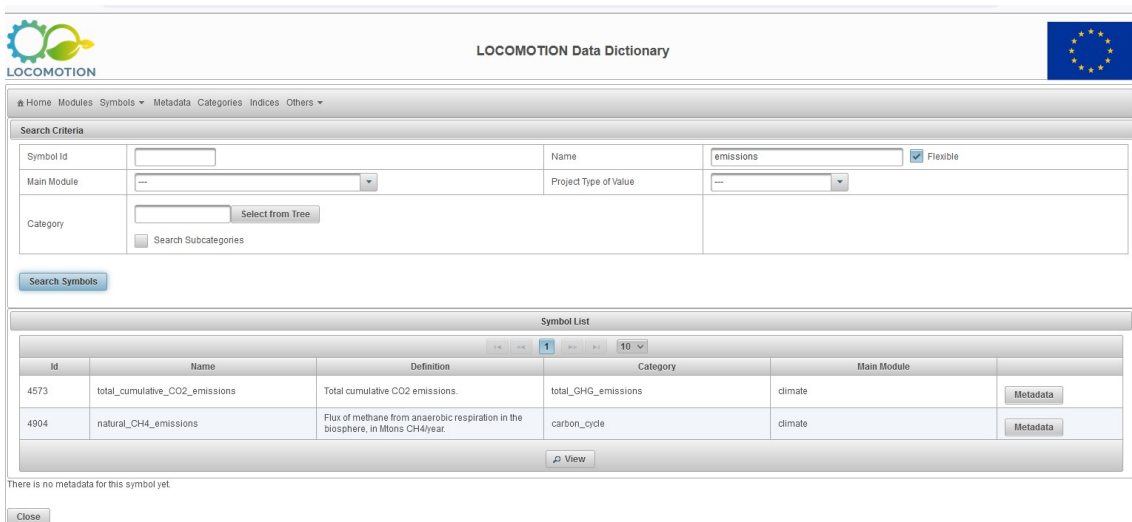


Figure 8. Example of a flexible Symbol Name search

View Symbol

The user can **view all the details of a Symbol** (Figure 26Figure 9). These include Symbol attributes, Input/Output attributes, Metadata, Secondary modules in which it is used and associated Indices through:

Menu/ Symbols/ View All Symbols: Select a Symbol in list and press "View"

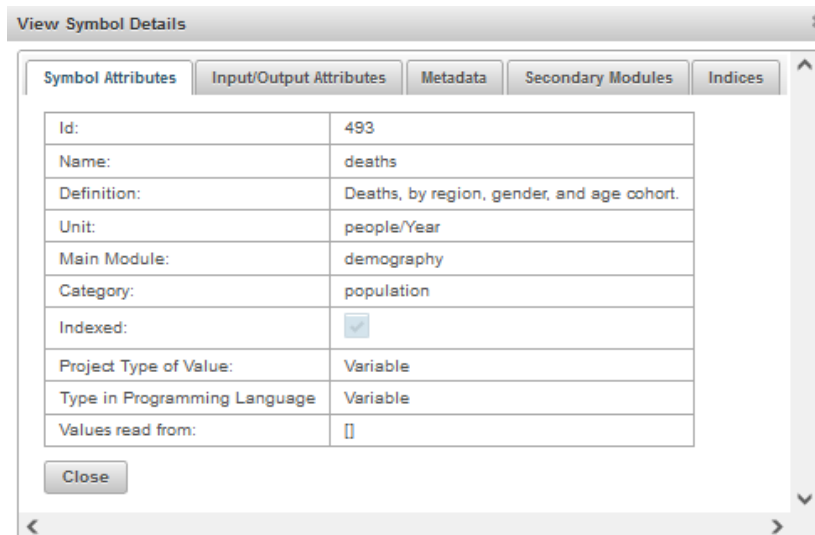


Figure 9. View Symbol details

NAMING CONVENTIONS

The user can **view detailed instructions on the Naming Conventions of the Symbols** through:

Menu/ Symbols/ Naming Conventions

This section includes information on the sources that have been considered to define naming conventions, the types of Symbols, Naming Convention rules and Automatic checking of naming convention rules.

METADATA QUALITY CHECK

The user can **view the results of the Metadata Quality Checks** through:

Menu/ Symbols/ Metadata Quality Checks

This section includes information on the Metadata Quality Checks that are performed by date, Asset (IndexValue, IndexDefinition, Metadata, Symbol) and Expectation Suite by level of severity (Warning, Critical, Error). By clicking on each asset and Expectation Suite users can see the overview of the quality check and the results by type of expectation. The metadata quality checks that run in the Data Dictionary by level of severity are presented in detail in Deliverable 2.7 (Papagianni et al., 2021).

1.1.4.1.3. METADATA

View Metadata

The user can **view Metadata** through:

Menu/ Metadata

This feature allows the user to have a general overview of the Metadata that have been used in the preparation of the Symbols.

The user can **view all the Metadata details of a dataset** through:

Menu/ Metadata: Select a dataset in list and press "View"

A detailed description of the Metadata fields that have been included is available in Annex I. Description of the metadata fields.

The user can download the Metadata in several formats, such as xlsx, csv and xml.

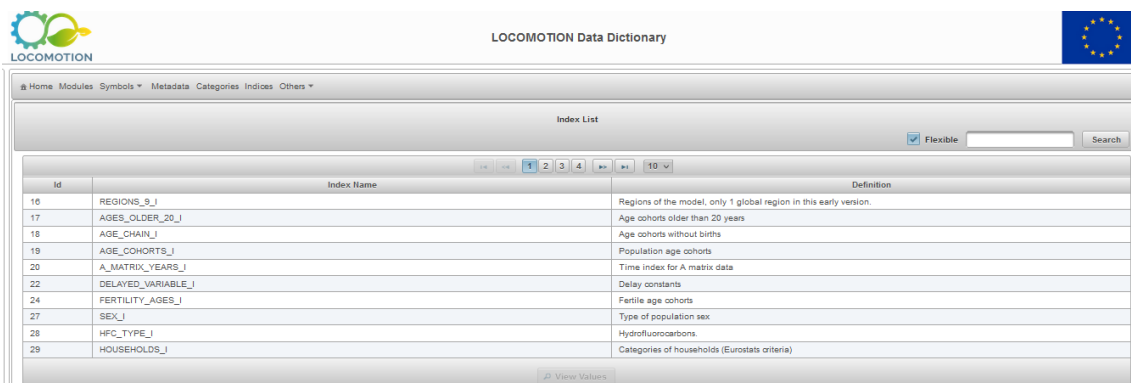
1.1.4.1.4. INDICES

View existing Indices

The user can **view existing Indices** (Figure 10) through:

Menu/ Indices

The user can filter indices with their name, doing a flexible or not search.



Id	Index Name	Definition
16	REGIONS_9_I	Regions of the model, only 1 global region in this early version.
17	AGES_OLDER_20_I	Age cohorts older than 20 years
18	AGE_CHAIN_I	Age cohorts without births
19	AGE_COHORTS_I	Population age cohorts
20	A_MATRIX_YEARS_I	Time index for A matrix data
22	DELAYED_VARIABLE_I	Delay constants
24	FERTILITY_AGES_I	Fertile age cohorts
27	SEX_I	Type of population sex
28	HFC_TYPE_I	Hydrofluorocarbons
29	HOUSEHOLDS_I	Categories of households (Eurostats criteria)

Figure 10. Indices List main page

The user can **view all the details of an Index** through:

Menu/ Index: Select an Index in list and press "View Values"

1.1.4.1.5. OTHERS

The user can access other entities of the Data Dictionary through:

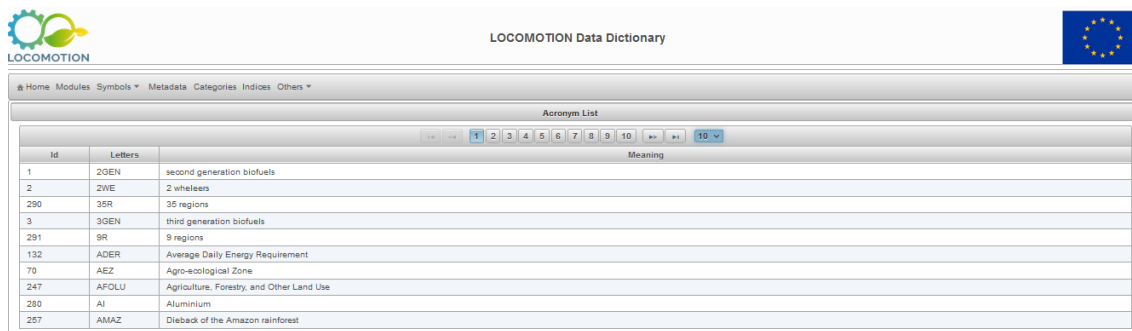
Menu/ Other entities

The features of these entities are described below.

ACRONYMS

The user can access the list of acronyms used and their meaning (Figure 11) through:

Menu/ Others/ Acronyms



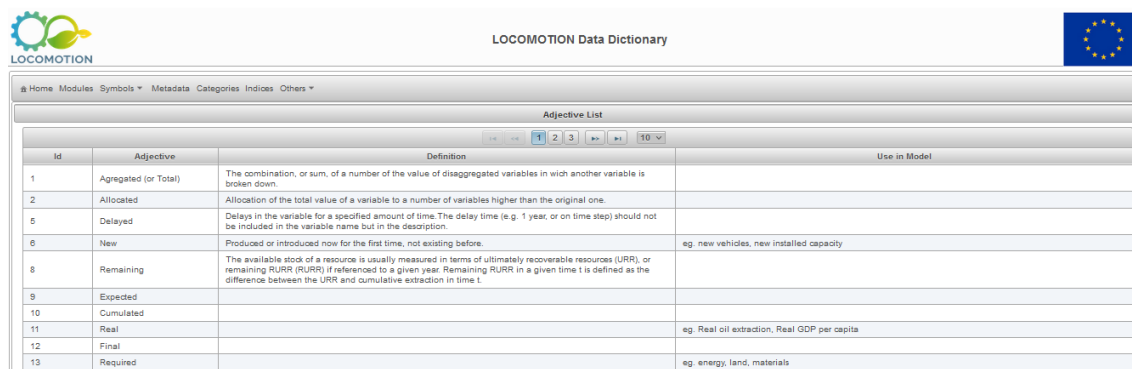
Id	Letters	Meaning
1	2GEN	second generation biofuels
2	2WE	2 wheeled
290	35R	35 regions
3	3GEN	third generation biofuels
291	9R	9 regions
132	ADER	Average Daily Energy Requirement
70	AEZ	Agro-ecological Zone
247	AFOLU	Agriculture, Forestry, and Other Land Use
280	AL	Aluminium
257	AMAZ	Dieback of the Amazon rainforest

Figure 11. Acronym List main page

ADJECTIVES

The user can access the list of adjectives used, their definitions and use in the model (Figure 12) through:

Menu/ Others/ Adjectives



Id	Adjective	Definition	Use in Model
1	Aggregated (or Total)	The combination, or sum, of a number of the value of disaggregated variables in which another variable is broken down.	
2	Allocated	Allocation of the total value of a variable to a number of variables higher than the original one.	
5	Delayed	Delays in the variable for a specified amount of time. The delay time (e.g. 1 year, or on time step) should not be included in the variable name but in the description.	
6	New	Produced or introduced now for the first time, not existing before.	eg. new vehicles, new installed capacity
8	Remaining	The available stock of a resource is usually measured in terms of ultimately recoverable resources (URR), or remaining RURR (RURR) if referenced to a given year. Remaining RURR in a given time t is defined as the difference between the URR and cumulative extraction in time t.	
9	Expedited		
10	Cumulated		
11	Real		eg. Real oil extraction, Real GDP per capita
12	Final		
13	Required		eg. energy, land, materials

Figure 12. Adjective List main page

SEMANTIC RULES

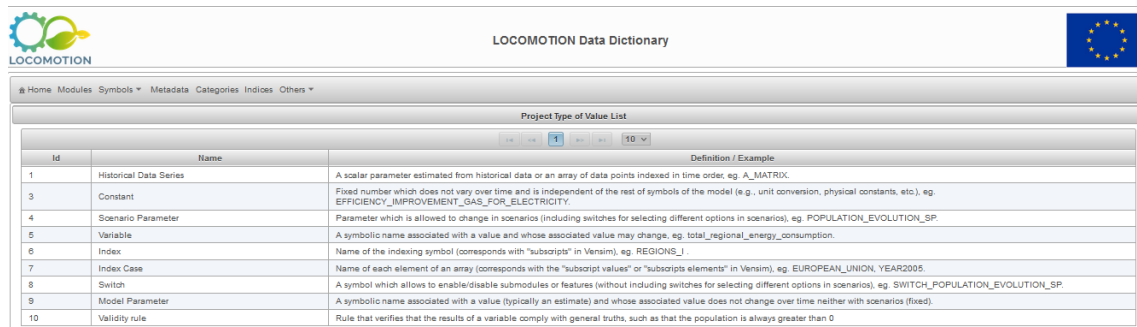
The user can access the list of semantic rules used and their explanation through:

Menu/ Others/ Semantic rules

PROJECT TYPE OF VALUES

The user can access the list of Project Type of Values and their definitions (Figure 13) through:

Menu/ Others/ Project Type of Values



Id	Name	Definition / Example
1	Historical Data Series	A scalar parameter estimated from historical data or an array of data points indexed in time order, eg. A_MATRIX.
3	Constant	Fixed number which does not vary over time and is independent of the rest of symbols of the model (e.g., unit conversion, physical constants, etc.), eg. EFFICIENCY_IMPROVEMENT_GAS_FOR_ELECTRICITY.
4	Scenario Parameter	Parameter which is allowed to change in scenarios (including switches for selecting different options in scenarios), eg. POPULATION_EVOLUTION_SP.
5	Variable	A symbolic name associated with a value and whose associated value may change, eg. total_regional_energy_consumption.
6	Index	Name of the indexing symbol (corresponds with "subscripts" in Vensim), eg. REGIONS_I.
7	Index Case	Name of each element of an array (corresponds with the "subscript values" or "subscripts elements" in Vensim), eg. EUROPEAN_UNION_YEAR2005.
8	Switch	A symbol which allows to enable/disable submodules or features (without including switches for selecting different options in scenarios), eg. SWITCH_POPULATION_EVOLUTION_SP.
9	Model Parameter	A symbolic name associated with a value (typically an estimate) and whose associated value does not change over time neither with scenarios (fixed).
10	Validity rule	Rule that verifies that the results of a variable comply with general truths, such as that the population is always greater than 0.

Figure 13. Project Type of Value List main page

PROGRAMMING LANGUAGE SYMBOL TYPES

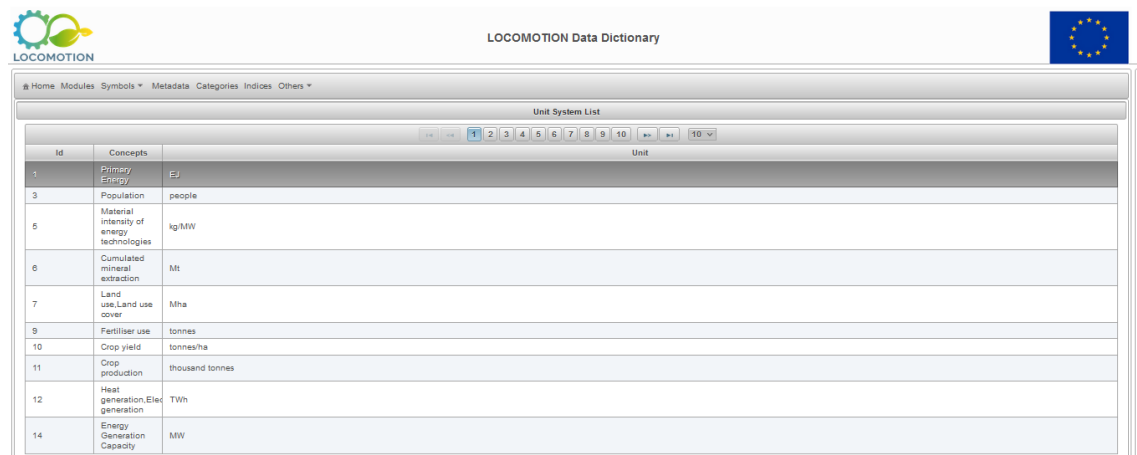
The user can access the list of Programming Language Symbol Types and their definitions through:

Menu/ Others/ Programming Language Symbol Types

UNIT SYSTEM

The user can access the list of Units used (Figure 14) through:

Menu/ Others/ Unit system



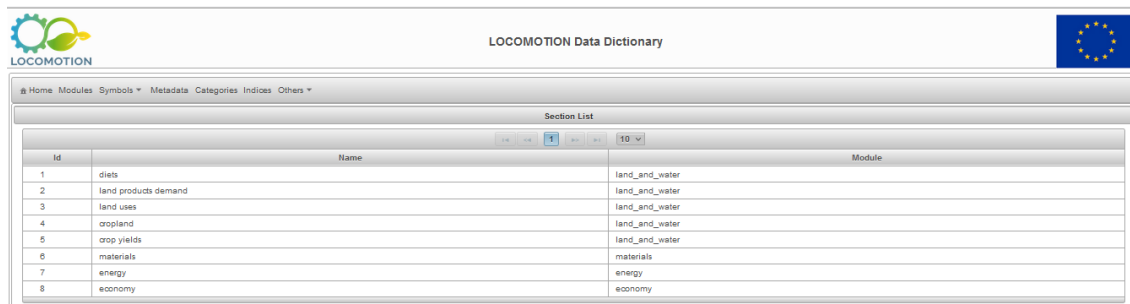
Id	Concepts	Unit
1	Primary Energy	EJ
3	Population	people
5	Material intensity of energy technologies	kg/MW
6	Cumulated mineral extraction	Mt
7	Land use/Land use cover	Mha
9	Fertiliser use	tonnes
10	Crop yield	tonnes/ha
11	Crop production	thousand tonnes
12	Heat generation, Elec generation	TWh
14	Energy Generation Capacity	MW

Figure 14. Unit System List main page

SECTIONS

The user can access the list of Sections (Figure 15) through:

Menu/ Others/ Sections



Id	Name	Module
1	diets	land_and_water
2	land_products_demand	land_and_water
3	land_uses	land_and_water
4	cropland	land_and_water
5	crop_yields	land_and_water
6	materials	materials
7	energy	energy
8	economy	economy

Figure 15. Section List main page

1.1.4.2. MODULE PROGRAMMER

The role of a Module Programmer entails the following aspects, as they can:

- Introduce a new Symbol that has as main module a module in which they participate. The new Symbol remains pending for validation.
- Associate an existing Symbol to a module in which they participate.
- View-edit all the Symbols associated with modules they participate in.
- View all the details of a Symbol. These include Symbol attributes, secondary modules in which it is used and associated indices.
- Modify the attributes of all the Symbols associated with modules they participate in. After the modification, these Symbols become pending for validation.
- Associate an existing index to a Symbol or disconnect an index from a Symbol associated with modules they participate in. In order to do so, the Symbol must have the attribute indexed=true.
- Add Metadata to a Symbol.
- View existing indices. Indices are shown in two different tabs, depending on whether they are validated or not. The user can filter indices with their name, doing a flexible or not search.
- Create a new index or edit an existing index. The new index remains pending for validation.
- Add a new index value to an index or edit an index value of an index.
- View all existing categories. Categories are shown in a tree structure.
- Create a new category for Symbols. If the new category belongs to levels 2 or 3, the user must declare its parent category. The new category remains pending for validation.
- Create or modify Metadata without connecting them with a Symbol.
- Only view all the other Symbols that are not associated with modules they participate in.
- View the modules in which they participate in the project and their role in each module.
- View all the other information about the Data Dictionary.

1.1.4.2.1. MAIN PAGE

The main page for a Module Programmer, the available Symbol actions, other options and profile options are presented in Figure 16, Figure 17, Figure 18 and Figure 19.

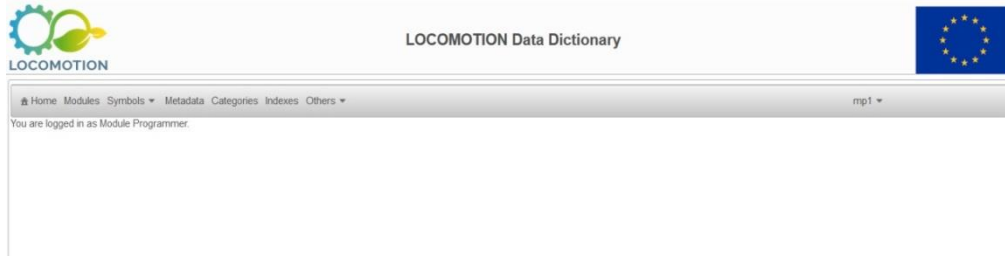


Figure 16. Module Programmer main page

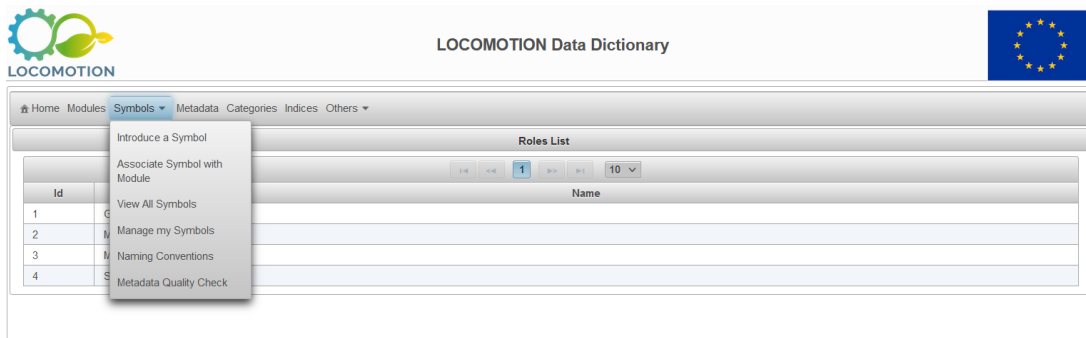


Figure 17. Module Programmer available Symbol actions

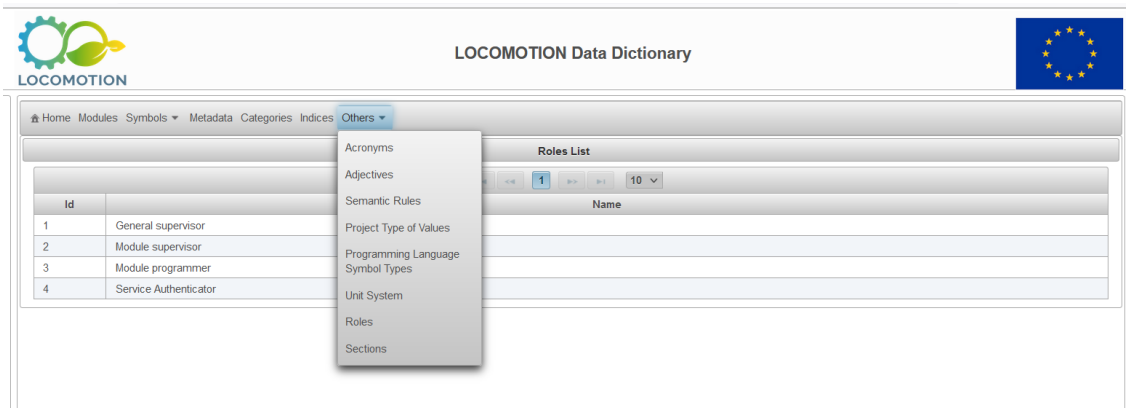


Figure 18. Module Programmer other options



Figure 19. Module Programmer profile options

1.1.4.2.2. SYMBOLS

INTRODUCTION OF A NEW SYMBOL

The user can introduce a new Symbol that has as a main module a module in which they participate. They must first choose a module among those they participate in and then create a new Symbol having this module as main module through:

Menu/ Symbols / Introduce a Symbol

The new Symbol remains pending for validation. The process for the introduction of a new Symbol can be seen in Figure 20 and Figure 21. There are some restrictions in introducing new Symbols. In order to apply a value to Project Type of Value and Programming Language Type, a match must exist between the two values. This match must have been previously created by a General Supervisor.

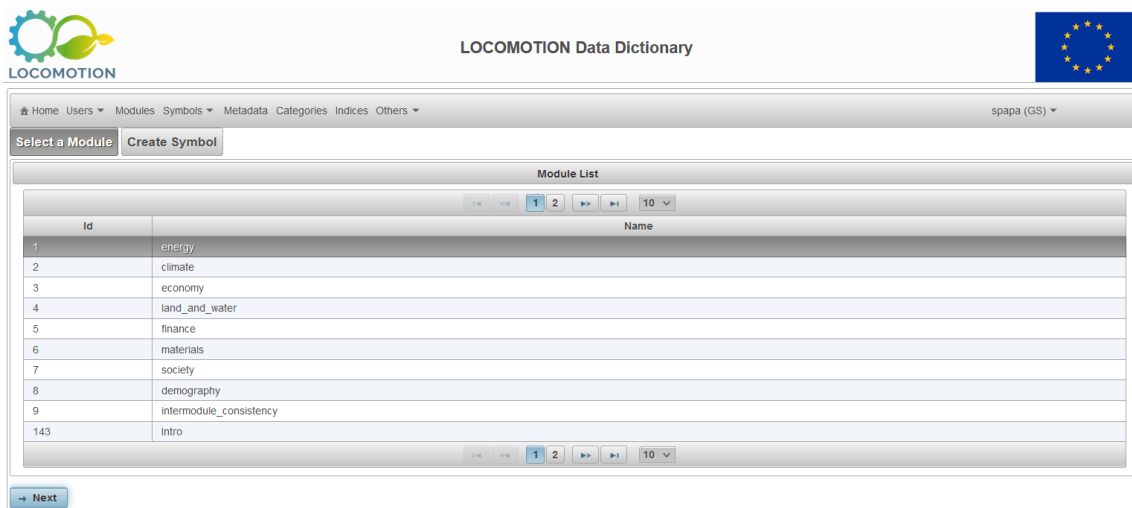
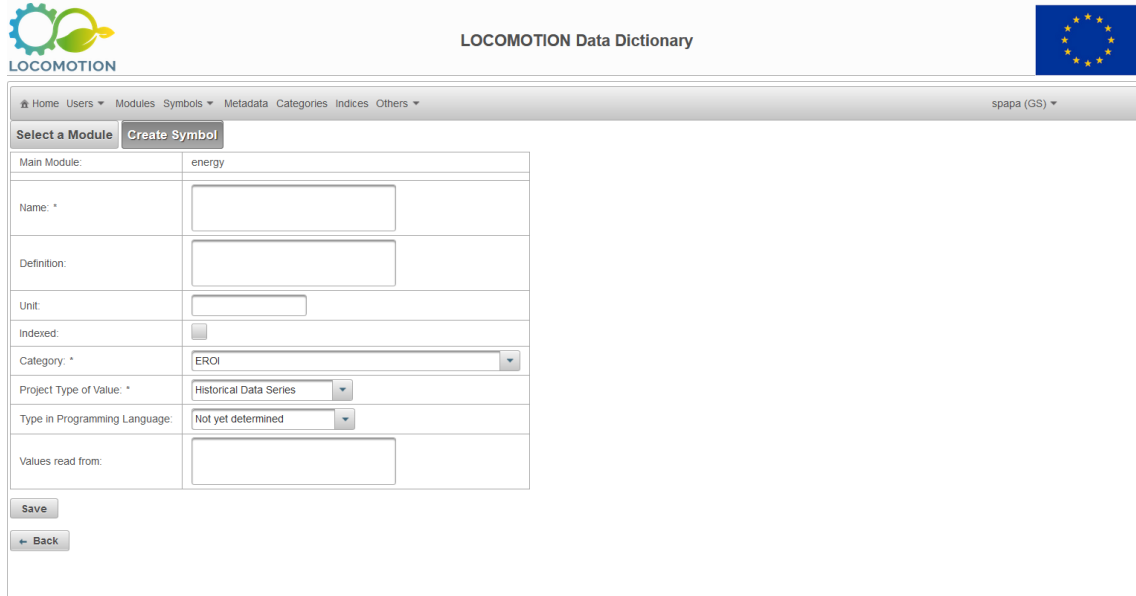


Figure 20. Introduction of a new Symbol, first step: Select a module



LOCOMOTION Data Dictionary

Home Users Modules Symbols Metadata Categories Indices Others spapa (GS)

Select a Module Create Symbol

Main Module: energy

Name: *

Definition:

Unit:

Indexed:

Category: * EROI

Project Type of Value: * Historical Data Series

Type in Programming Language: Not yet determined

Values read from:

Save

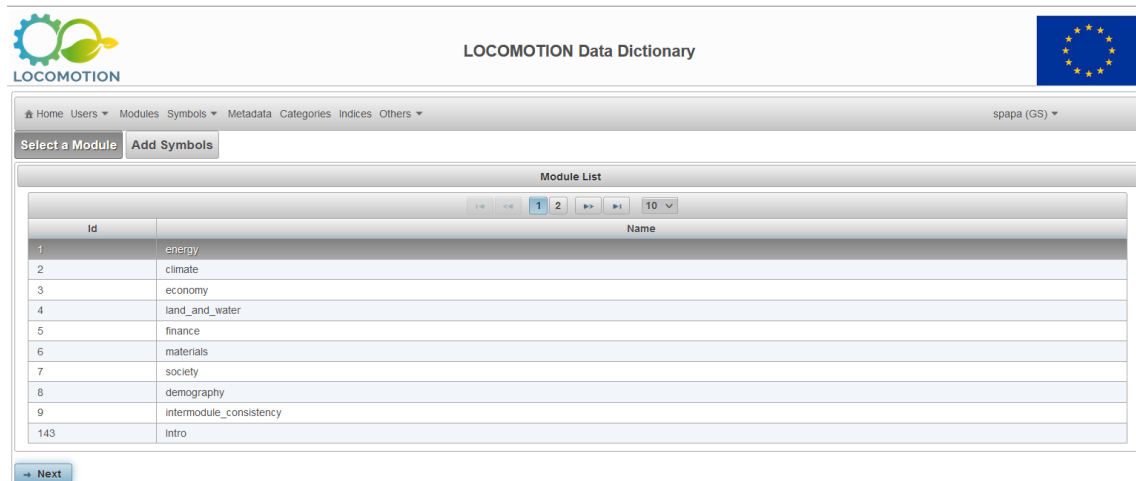
Back

Figure 21. Introduction of a new Symbol, second step: Create Symbol by filling Symbol properties

ASSOCIATION OF AN EXISTING SYMBOL TO A MODULE

The user can associate an existing Symbol to a module in which they participate in, as it can be seen in Figure 22 and Figure 23. They must first choose a module among those they participate in and then choose one or more existing Symbols to associate them with through:

Menu/ Symbols/ Associate Symbol with Module



LOCOMOTION Data Dictionary

Home Users Modules Symbols Metadata Categories Indices Others spapa (GS)

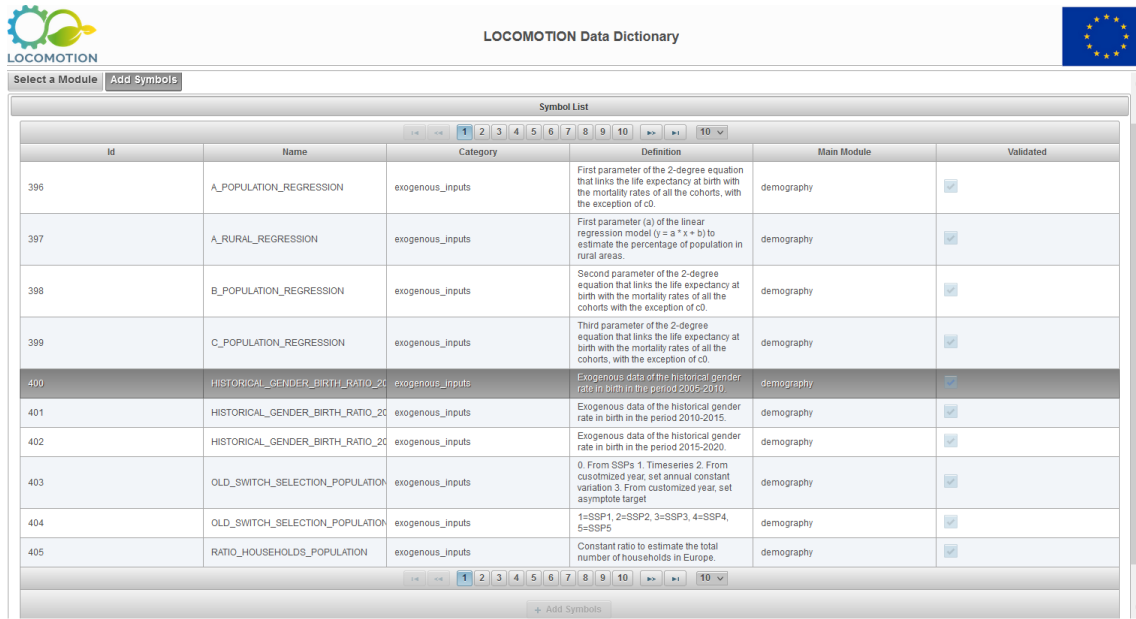
Select a Module Add Symbols

Module List

Id	Name
1	energy
2	climate
3	economy
4	land_and_water
5	finance
6	materials
7	society
8	demography
9	intermodule_consistency
143	Intro

Next

Figure 22. Associate Symbols, first step: Select a module



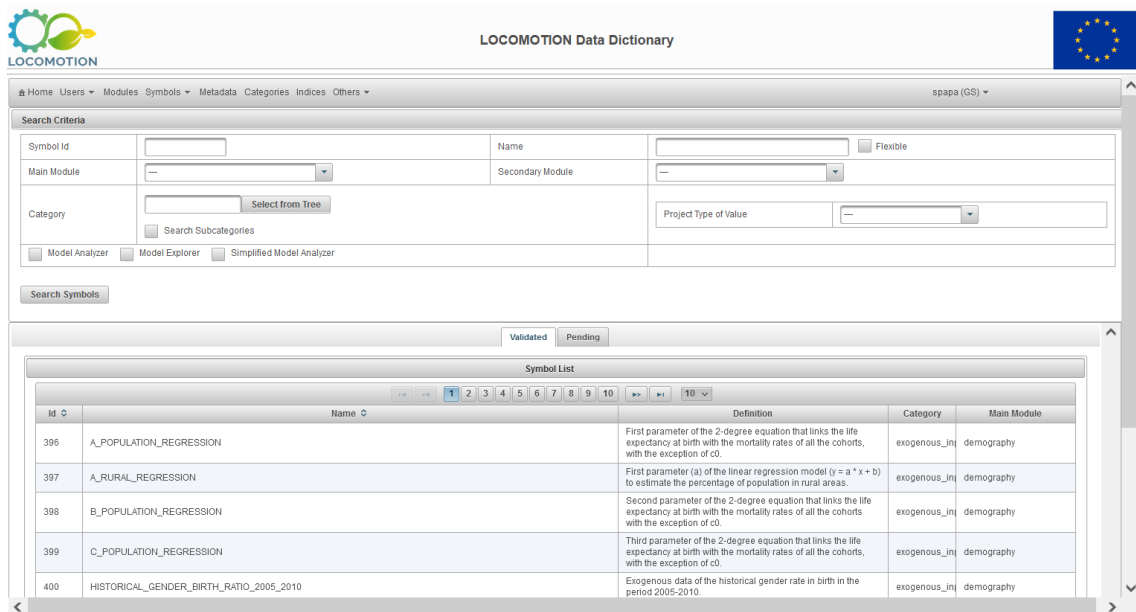
Id	Name	Category	Definition	Main Module	Validated
396	A_POPULATION_REGRESSION	exogenous_inputs	First parameter of the 2-degree equation that links the life expectancy at birth with the mortality rates of all the cohorts, with the exception of c0.	demography	<input checked="" type="checkbox"/>
397	A_RURAL_REGRESSION	exogenous_inputs	First parameter (a) of the linear regression model (y = a * x + b) to estimate the percentage of population in rural areas.	demography	<input checked="" type="checkbox"/>
398	B_POPULATION_REGRESSION	exogenous_inputs	Second parameter of the 2-degree equation that links the life expectancy at birth with the mortality rates of all the cohorts with the exception of c0.	demography	<input checked="" type="checkbox"/>
399	C_POPULATION_REGRESSION	exogenous_inputs	Third parameter of the 2-degree equation that links the life expectancy at birth with the mortality rates of all the cohorts, with the exception of c0.	demography	<input checked="" type="checkbox"/>
400	HISTORICAL_GENDER_BIRTH_RATIO_2005_2010	exogenous_inputs	Exogenous data of the historical gender rate in birth in the period 2005-2010.	demography	<input checked="" type="checkbox"/>
401	HISTORICAL_GENDER_BIRTH_RATIO_2010_2015	exogenous_inputs	Exogenous data of the historical gender rate in birth in the period 2010-2015.	demography	<input checked="" type="checkbox"/>
402	HISTORICAL_GENDER_BIRTH_RATIO_2015_2020	exogenous_inputs	Exogenous data of the historical gender rate in birth in the period 2015-2020.	demography	<input checked="" type="checkbox"/>
403	OLD_SWITCH_SELECTION_POPULATION	exogenous_inputs	0. From SSPs 1. Timeseries 2. From customized year, set annual constant variation 3. From customized year, set asymptote target	demography	<input checked="" type="checkbox"/>
404	OLD_SWITCH_SELECTION_POPULATION	exogenous_inputs	1=SSP1, 2=SSP2, 3=SSP3, 4=SSP4, 5=SSP5	demography	<input checked="" type="checkbox"/>
405	RATIO_HOUSEHOLDS_POPULATION	exogenous_inputs	Constant ratio to estimate the total number of households in Europe.	demography	<input checked="" type="checkbox"/>

Figure 23. Associate Symbols, next step: Add Symbols

VIEW-EDIT SYMBOLS

The user can view-edit all the Symbols associated with modules they participate in from a central management page, as it can be seen in Figure 24. In this page, Symbols are shown in two different tabs, depending on whether they are validated or not. The user can view-edit all the Symbols associated with modules they participate in through:

Menu/ Symbols/ Manage my Symbols



Id	Name	Definition	Category	Main Module
396	A_POPULATION_REGRESSION	First parameter of the 2-degree equation that links the life expectancy at birth with the mortality rates of all the cohorts, with the exception of c0.	exogenous_in	demography
397	A_RURAL_REGRESSION	First parameter (a) of the linear regression model (y = a * x + b) to estimate the percentage of population in rural areas.	exogenous_in	demography
398	B_POPULATION_REGRESSION	Second parameter of the 2-degree equation that links the life expectancy at birth with the mortality rates of all the cohorts with the exception of c0.	exogenous_in	demography
399	C_POPULATION_REGRESSION	Third parameter of the 2-degree equation that links the life expectancy at birth with the mortality rates of all the cohorts, with the exception of c0.	exogenous_in	demography
400	HISTORICAL_GENDER_BIRTH_RATIO_2005_2010	Exogenous data of the historical gender rate in birth in the period 2005-2010.	exogenous_in	demography

Figure 24. Manage my Symbols page

In this page the user has several options:

Search for a Symbol

The user can use **search criteria to filter the Symbol**. These criteria include the Symbol ID, the Symbol name, the main or a secondary module of the Symbol, the Symbol category and the Project Type of Value of the Symbol. In case the search is performed based on the Symbol Name, the search can be flexible or not, i.e., the Symbol Name must match exactly or partially the search text. An example of a flexible Symbol Name search is presented in Figure 25.

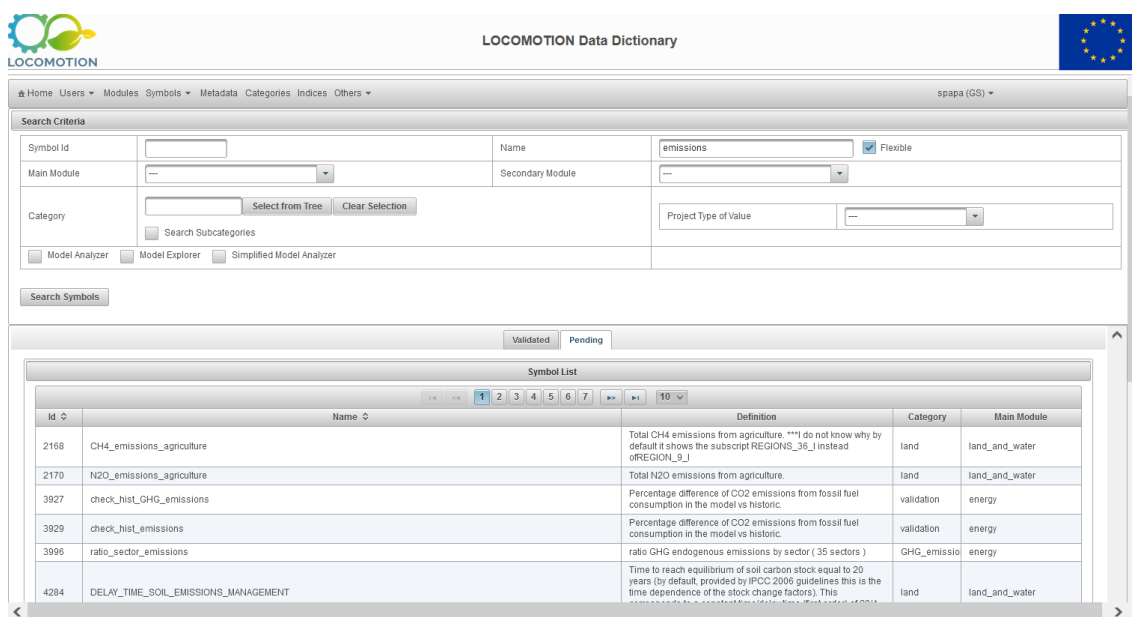


Figure 25. Example of a flexible Symbol Name search

View Symbol

The user can **view all the details of a Symbol** (Figure 26). These include Symbol attributes, Input/Output attributes, Metadata, Secondary modules in which it is used and associated Indices through:

Menu/ Symbols/ Manage my Symbols: Select a Symbol in list and press "View"

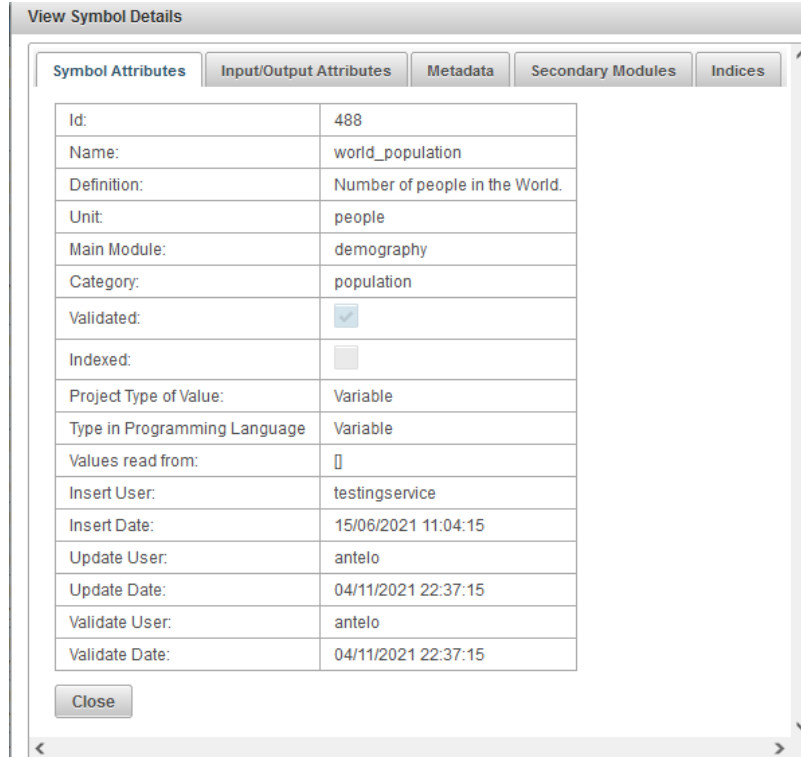


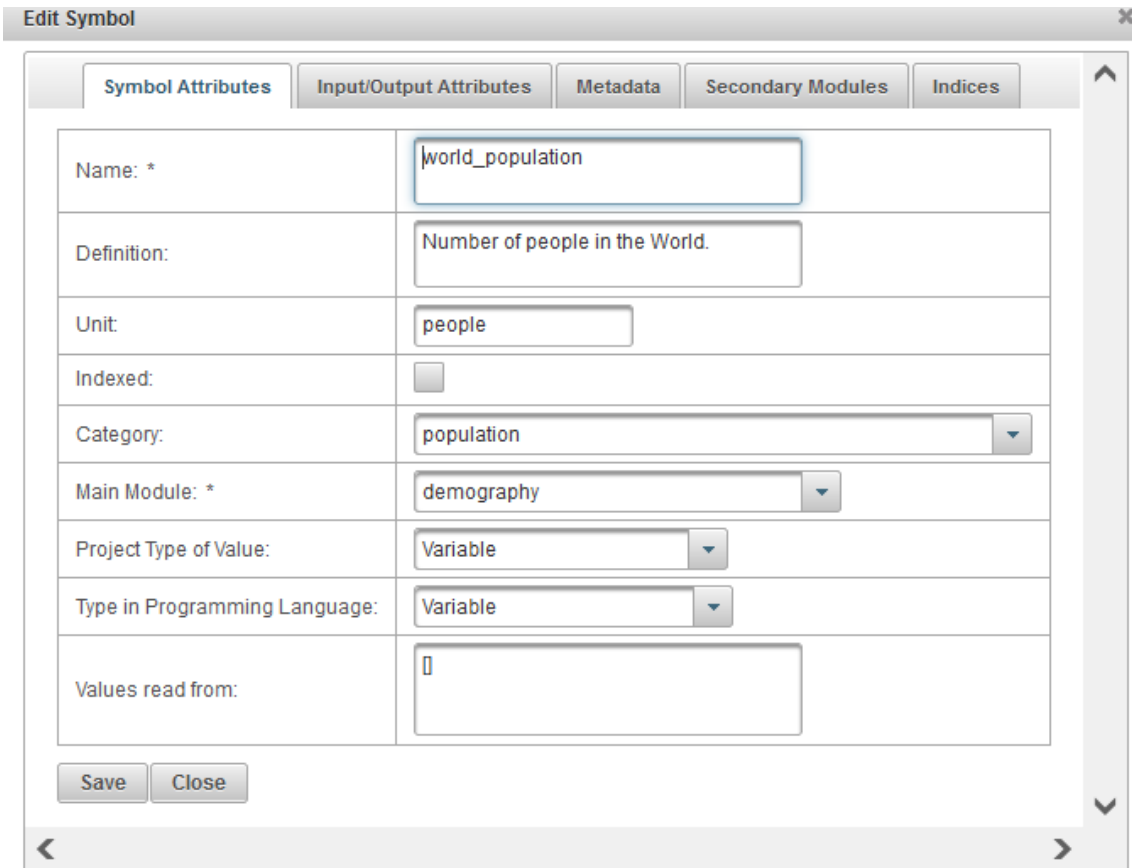
Figure 26. View Symbol details

Edit Symbol

The user can **modify the attributes** of all the Symbols associated with modules they participate in, as it can be seen in Figure 27, through:

Menu/ Symbols/ Manage my Symbols: Select a Symbol in list and press "Edit", "Symbol attributes"

After the modification, these Symbols become pending for validation.



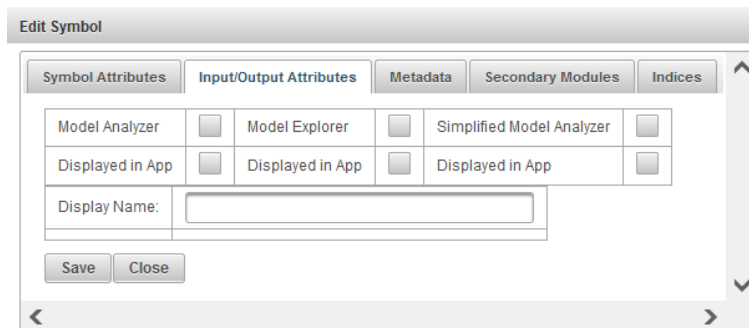
Name: *	world_population
Definition:	Number of people in the World.
Unit:	people
Indexed:	<input type="checkbox"/>
Category:	population
Main Module: *	demography
Project Type of Value:	Variable
Type in Programming Language:	Variable
Values read from:	

Save Close

Figure 27. Edit Symbol Attributes

The user can **add Input/Output Attributes to a Symbol** through:

Menu/ Symbols/ Manage my Symbols: Select a Symbol in list and press "Edit", "Input/Output Attributes", as it can be seen in Figure 28.



Model Analyzer	<input type="checkbox"/>	Model Explorer	<input type="checkbox"/>	Simplified Model Analyzer	<input type="checkbox"/>
Displayed in App	<input type="checkbox"/>	Displayed in App	<input type="checkbox"/>	Displayed in App	<input type="checkbox"/>
Display Name:					

Save Close

Figure 28. Add Input/Output Attributes to a Symbol

The user can **add new Metadata to a Symbol** through:

Menu/ Symbols/ Manage my Symbols: Select a Symbol in list and press "Edit", then in the Metadata tab press "Add Metadata", as it can be seen in Figure 29.

A detailed description of the Metadata fields that have been included is available in Annex I. Description of the metadata fields.

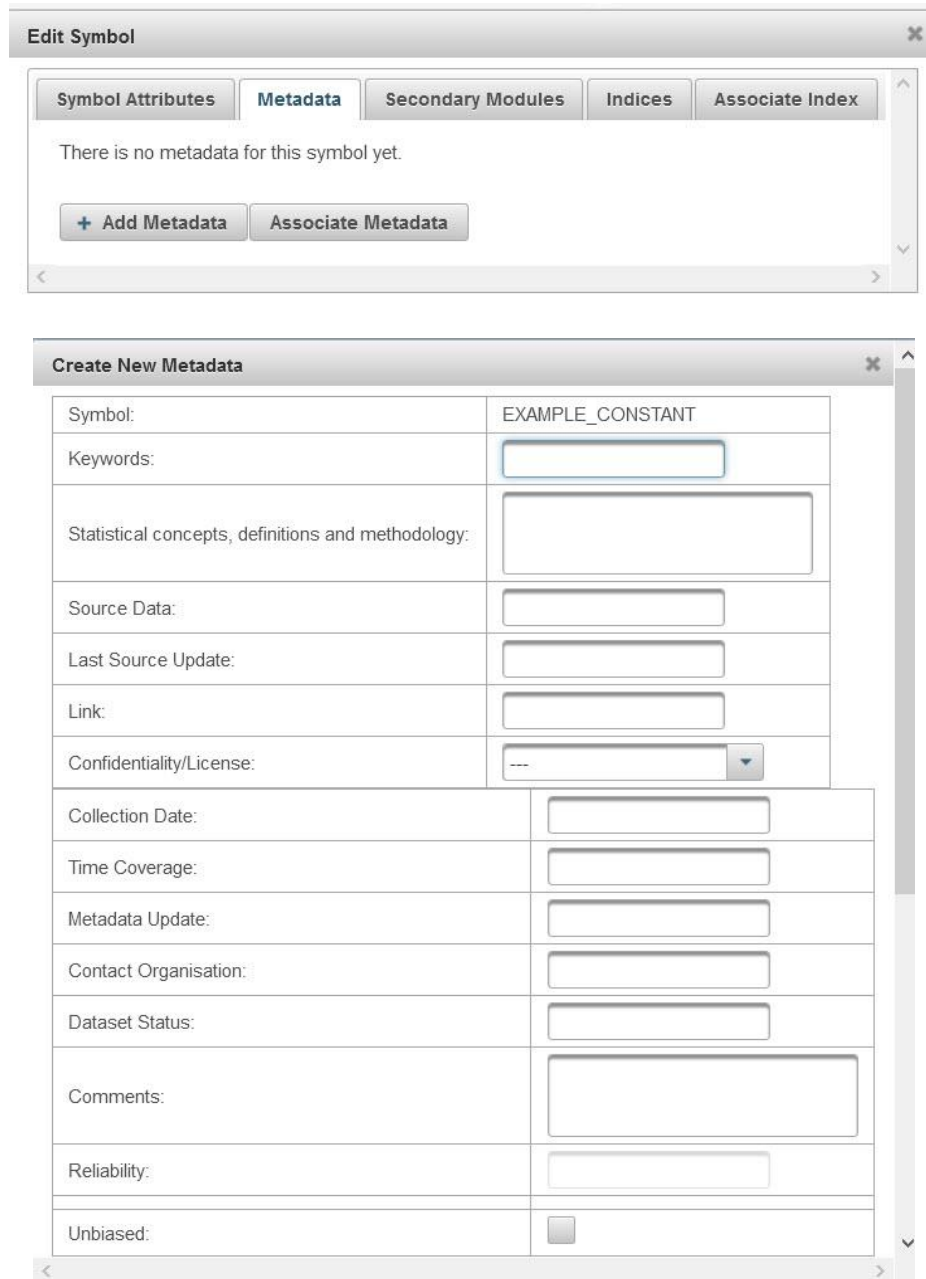


Figure 29. Add Metadata to a Symbol

The user can **associate Metadata to a Symbol** through:

Menu/ Symbols/ Manage my Symbols: Select a Symbol in list and press "Edit", then in the Metadata tab press "Associate Metadata", as it can be seen in Figure 30.

The user can select the dataset and then press "Associate".

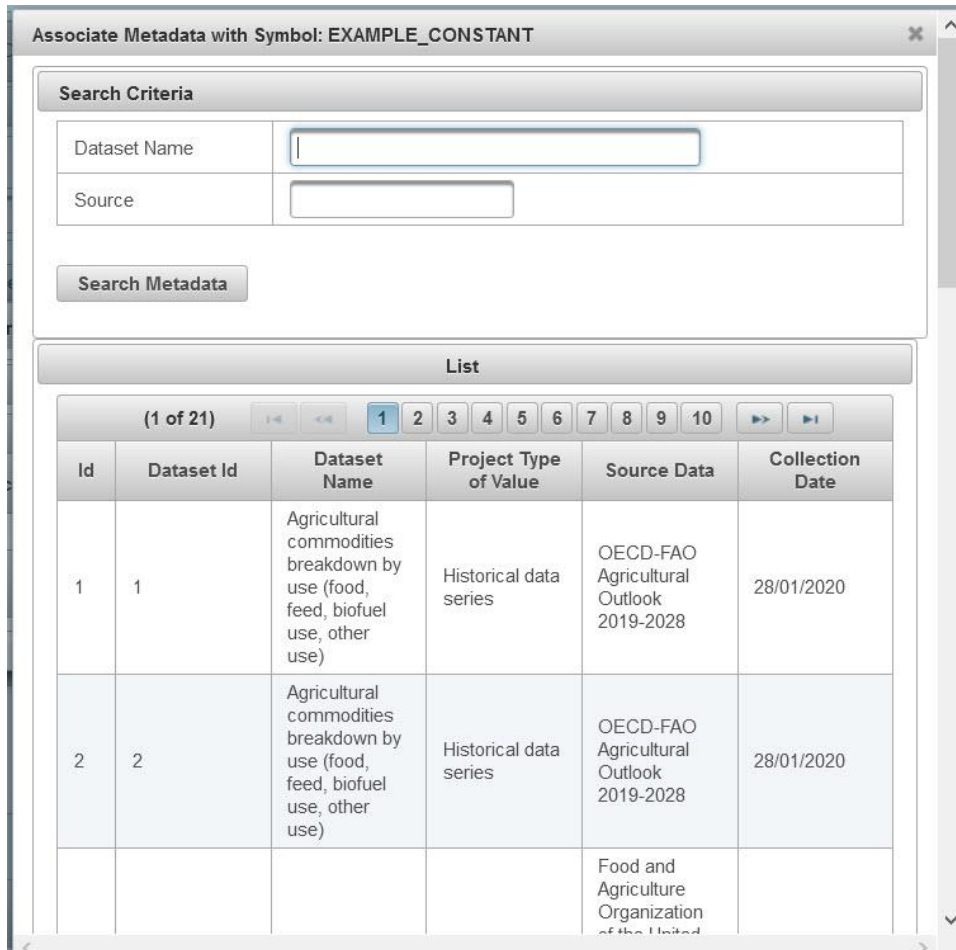


Figure 30. Associate Metadata to a Symbol

The user can **disconnect a Secondary Module from a Symbol** through:

Menu/ Symbols/ Manage my Symbols: Select a Symbol in list and press "Edit", "Secondary modules", as it can be seen in Figure 31.

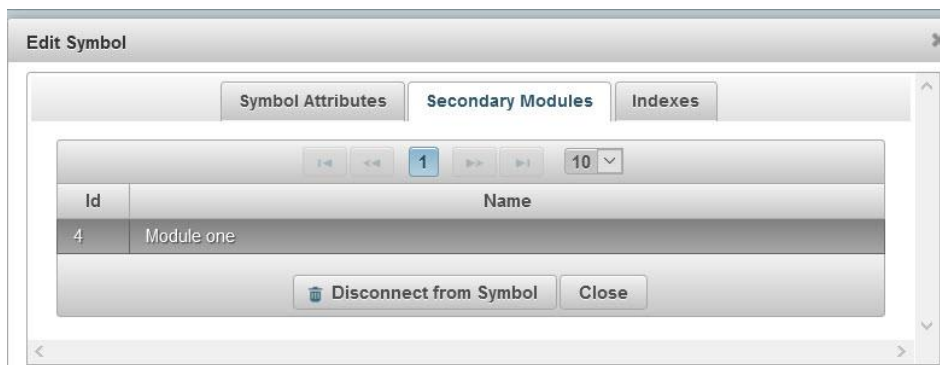


Figure 31. Remove Symbol from a Module

The user can **associate an existing Index to a Symbol** associated with modules they participate in, as it can be seen in Figure 32 through:

Menu/ Symbols/ Manage my Symbols: Select a Symbol in list and press "Edit", "Associate Index"

In order to do so, the Symbol must have the attribute indexed=true.

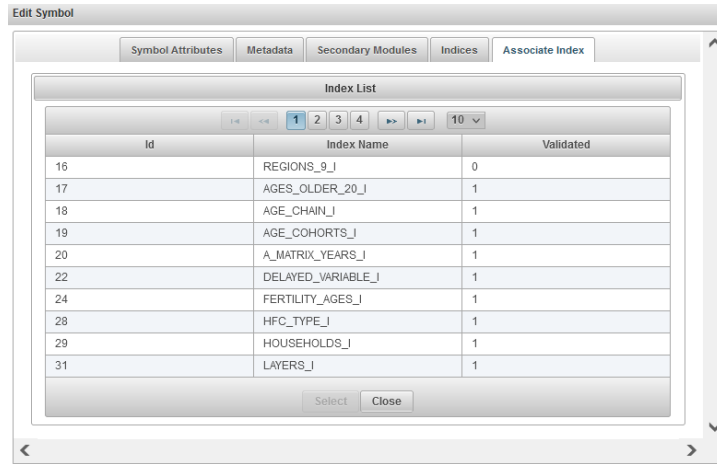


Figure 32. Associate Index to Symbol

The user can **disconnect an Index from a Symbol** through:

Menu/ Symbols/ Manage my Symbols: Select a Symbol in list and press "Edit", "Indices", as demonstrated in Figure 33.

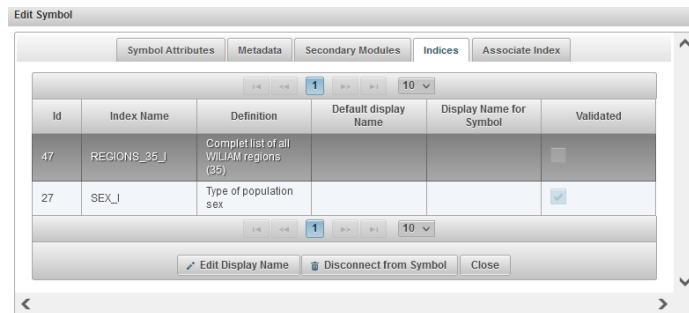


Figure 33. Remove Index from Symbol

Delete Symbol

The user can **delete a Symbol** through:

Menu/ Symbols/ Manage my Symbols: Select a Symbol in list and press "Delete"

NAMING CONVENTIONS

The user can **view detailed instructions on the Naming Conventions of the Symbols** though:

Menu/ Symbols/ Naming Conventions

This section includes information on the sources that have been considered to define naming conventions, the types of Symbols, Naming Convention rules and Automatic checking of naming convention rules.

METADATA QUALITY CHECK

The user can **view the results of the Metadata Quality Checks** through:

Menu/ Symbols/ Metadata Quality Checks

This section includes information on the Metadata Quality Checks that are performed by date, Asset (IndexValue, IndexDefinition, Metadata, Symbol) and Expectation Suite by level of severity (Warning, Critical, Error). By clicking on each asset and Expectation Suite users can see the overview of the quality check and the results by type of expectation.

1.1.4.2.3. METADATA

View Metadata

The user can **view Metadata** without connecting them with a Symbol, through:

Menu/ Metadata

The user can **view all the Metadata details of a dataset** through:

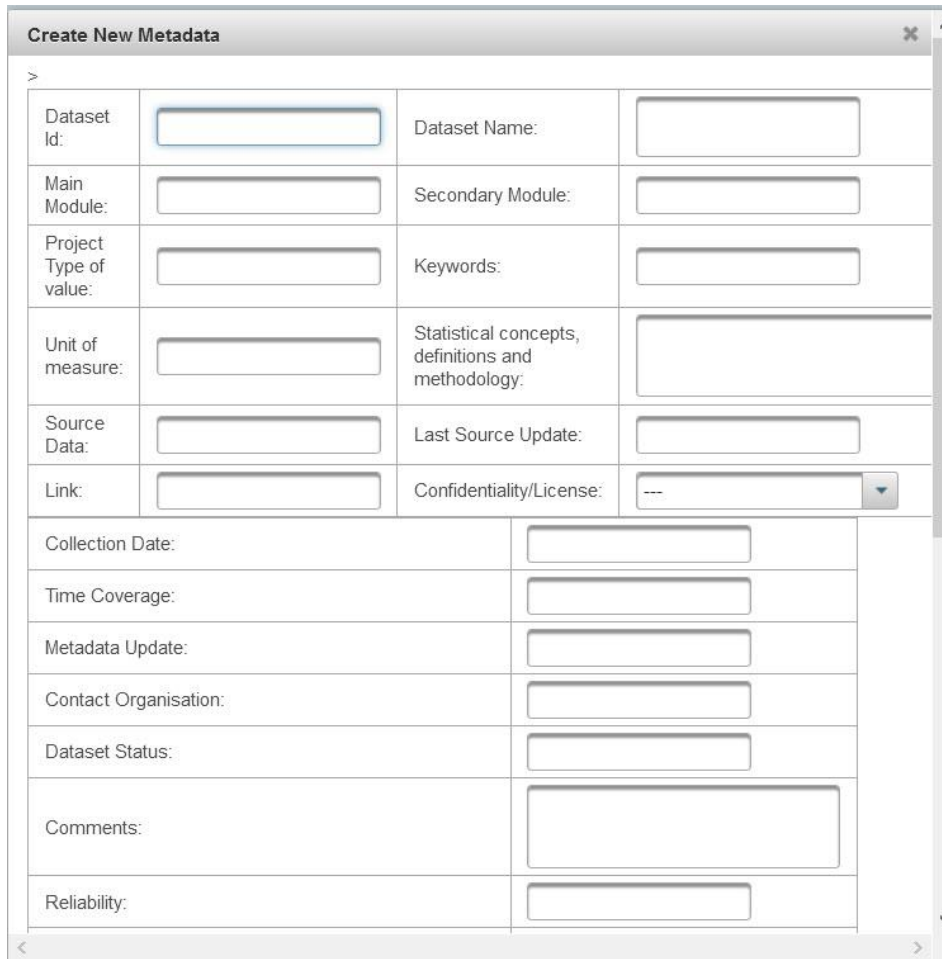
Menu/ Metadata: Select a dataset in list and press "View"

A detailed description of the Metadata fields that have been included is available in Annex I. Description of the metadata fields.

Create or Edit Metadata

The user can **create or modify Metadata** without connecting them with a Symbol, as presented in Figure 34 through:

Menu/ Metadata: In the bottom part of the list press "Create" or "Edit"



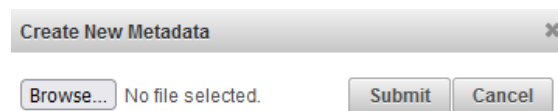
Dataset Id:	<input type="text"/>	Dataset Name:	<input type="text"/>
Main Module:	<input type="text"/>	Secondary Module:	<input type="text"/>
Project Type of value:	<input type="text"/>	Keywords:	<input type="text"/>
Unit of measure:	<input type="text"/>	Statistical concepts, definitions and methodology:	<input type="text"/>
Source Data:	<input type="text"/>	Last Source Update:	<input type="text"/>
Link:	<input type="text"/>	Confidentiality/License:	---
Collection Date:	<input type="text"/>		
Time Coverage:	<input type="text"/>		
Metadata Update:	<input type="text"/>		
Contact Organisation:	<input type="text"/>		
Dataset Status:	<input type="text"/>		
Comments:	<input type="text"/>		
Reliability:	<input type="text"/>		

Figure 34. Create New Metadata not bound to a Symbol

Import Metadata

The user can **create Metadata** without connecting them with a Symbol **by importing information** from the excel metadata template created for this purpose, as it can be seen in Figure 35, through:

Menu/ Metadata: In the bottom part of the list press "Create from Excel Template".



No file selected.

Figure 35. Create New Metadata by importing information

Delete Metadata

The user can **delete Metadata for a dataset** through:

Menu/ Metadata: Select a dataset in list and press "Delete"

1.1.4.2.4. CATEGORIES

View existing categories

The user can **view all existing categories** through:

Menu/ Categories

Categories are shown in a tree structure (Figure 36).

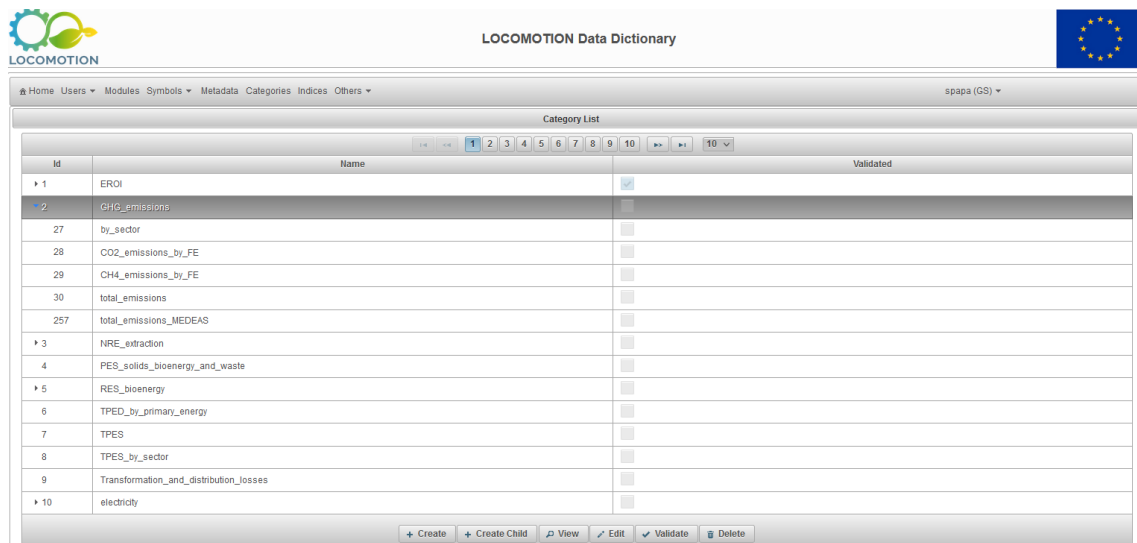


Figure 36. Category List main page

The user can **view all the details of a category** through:

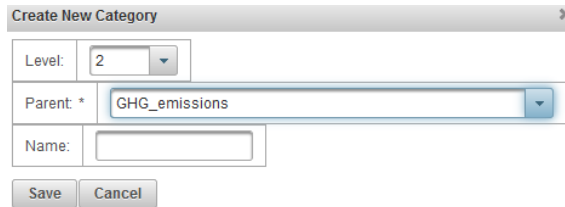
Menu/ Category: Select a Category in list and press "View"

Create new category

The user can **create a new category** in which Symbols belong through:

Menu/ Categories: In the bottom part of the list press "Create"

If the new category belongs to levels 2 or 3, the user must declare its parent category, as seen in Figure 37. The new category remains pending for validation.



The screenshot shows a dialog box titled "Create New Category" with a close button (X) in the top right corner. It contains the following fields:

- Level:** A dropdown menu with the value "2" selected.
- Parent:** A dropdown menu with "GHG_emissions" selected.
- Name:** An empty text input field.

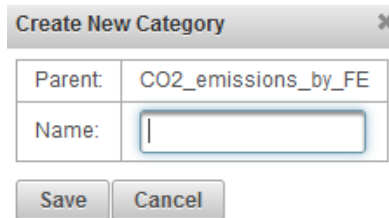
 At the bottom of the dialog are two buttons: "Save" and "Cancel".

Figure 37. Create New Category

The user can **create a new category as a child of an existing** (Figure 38) through:

Menu/ Categories: Select a category and in the bottom part of the list press "Create Child"

The new category remains pending for validation.



The screenshot shows a dialog box titled "Create New Category" with a close button (X) in the top right corner. It contains the following fields:

- Parent:** A dropdown menu with "CO2_emissions_by_FE" selected.
- Name:** An empty text input field.

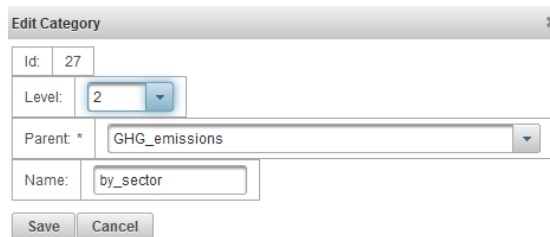
 At the bottom of the dialog are two buttons: "Save" and "Cancel".

Figure 38. Create New Category as Child of an Existing

Edit a category

The user can **edit a category** in which Symbols belong (Figure 39) through:

Menu/ Categories: Select a category and in the bottom part of the list press "Edit"



The screenshot shows a dialog box titled "Edit Category" with a close button (X) in the top right corner. It contains the following fields:

- Id:** A text input field containing the value "27".
- Level:** A dropdown menu with the value "2" selected.
- Parent:** A dropdown menu with "GHG_emissions" selected.
- Name:** A text input field containing the value "by_sector".

 At the bottom of the dialog are two buttons: "Save" and "Cancel".

Figure 39. Edit a Category

Delete a category

The user can **delete a category** in which Symbols belong through:

Menu/ Categories: Select a category and in the bottom part of the list press "Delete"

1.1.4.2.5. INDICES

View existing Indices

The user can **view existing Indices** (Figure 40) through:

Menu/ Indices

Indices are shown in two different tabs, depending on whether they are validated or not. The user can filter indices with their name, doing a flexible or not search.

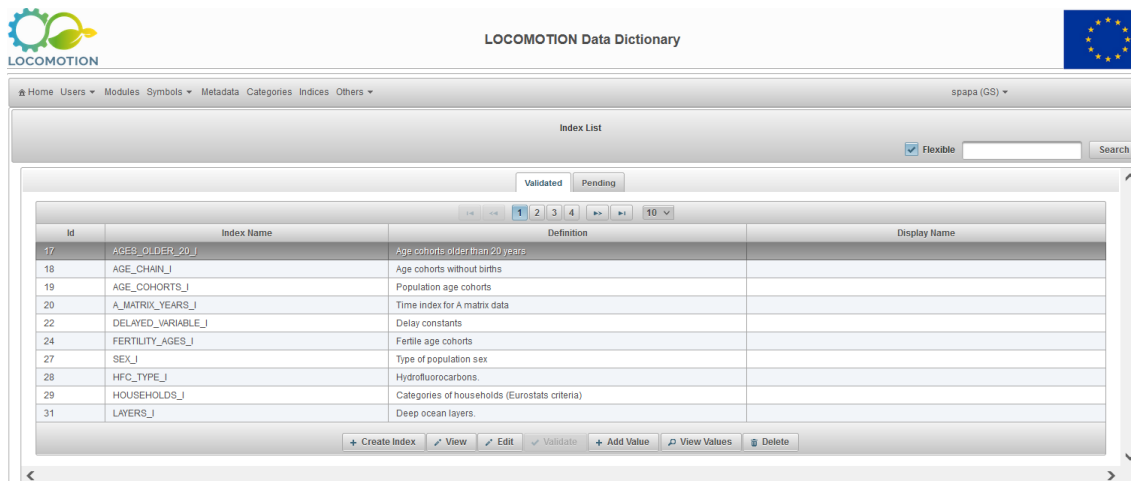


Figure 40. Indices List main page

The user can **view all the details of an Index** through:

Menu/ Index: Select an Index in list and press "View"

Create New Index

The user can **create a New Index**, as seen in Figure 41, through:

Menu/ Indices: In the bottom part of the list press "Create Index"

The new index remains pending for validation.

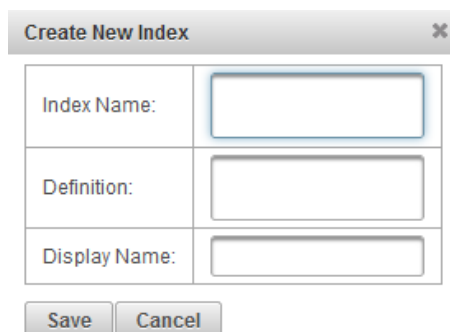


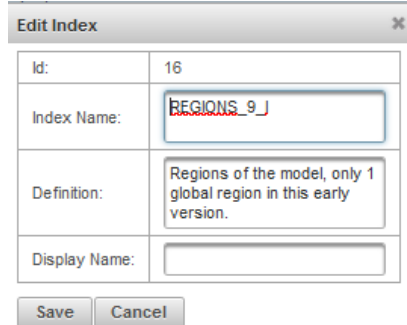
Figure 41. Create New Index

Edit an Index

The user can **edit an Index**, as it can be seen in Figure 42, through:

Menu/ Indices: Select an index and in the bottom part of the list press "Edit"

The new index remains pending for validation.



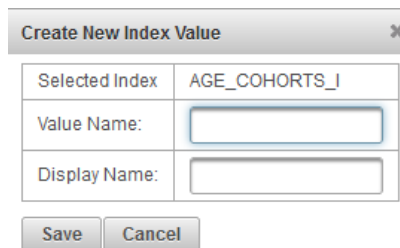
Edit Index	
Id:	16
Index Name:	REGIONS_9_I
Definition:	Regions of the model, only 1 global region in this early version.
Display Name:	
<input type="button" value="Save"/> <input type="button" value="Cancel"/>	

Figure 42. Edit an Index

Create an Index Value

The user can **add a New Index Value to an Index** , as seen in Figure 43 through:

Menu/ Indices: Select an index and in the bottom part of the list press "Add Value"



Create New Index Value	
Selected Index	AGE_COHORTS_I
Value Name:	
Display Name:	
<input type="button" value="Save"/> <input type="button" value="Cancel"/>	

Figure 43. Add New Value to an Index

Edit or Remove an Index Value

The user can **edit an Index Value** through:

Menu/ Indices: Select an Index and in the bottom part of the list press "View Values", then in the pop up window select a value and press "Edit Value"

The user can **remove an Index Value** through:

Menu/ Indices: Select an Index and in the bottom part of the list press "View Values", then in the pop up window select a value and press "Remove Value"

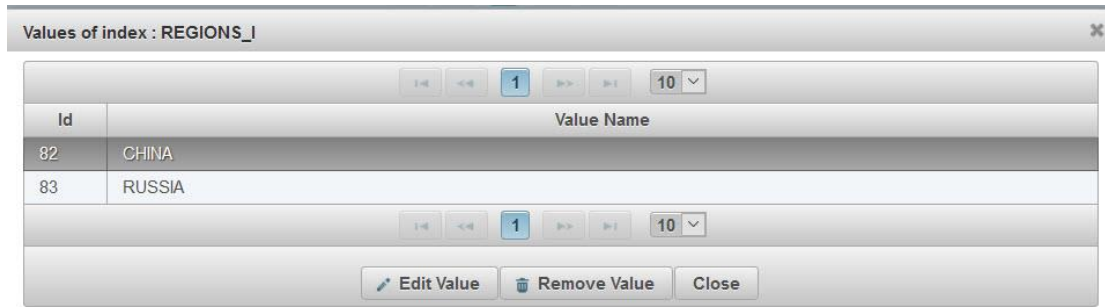


Figure 44. View, Edit or Remove Values of an Index

Delete Index

The user can **delete an Index** through:

Menu/ Indices: Select an Index in list and press "Delete"

1.1.4.2.6. OTHERS

The user can access other entities of the Data Dictionary through:

Menu/ Other entities

The features of these entities are described below.

ACRONYMS

The user can access the list of acronyms used and their meaning through:

Menu/ Others/ Acronyms

ADJECTIVES

The user can access the list of adjectives used, their definitions and use in the model through:

Menu/ Others/ Adjectives

SEMANTIC RULES

The user can access the list of semantic rules used and their explanation through:

Menu/ Others/ Semantic rules

PROJECT TYPE OF VALUES

The user can access the list of Project Type of Values and their definitions through:

Menu/ Others/ Project Type of Values

PROGRAMMING LANGUAGE SYMBOL TYPES

The user can access the list of Programming Language Symbol Types and their definitions through:

Menu/ Others/ Programming Language Symbol Types

UNIT SYSTEM

The user can access the list of Units used through:

Menu/ Others/ Unit system

ROLES

The user can access the list of Roles used through:

Menu/ Others/ Roles

SECTIONS

The user can access the list of Sections through:

Menu/ Others/ Sections

1.1.4.2.7. OTHER USER INFORMATION

- The user can only view all the other Symbols that are not associated with modules they participate in.
- The user can view the modules in which they participate in the project and their role in each module through:

Menu/ Username/ My Roles, as seen in Figure 45.



Figure 45. View Roles in Modules

- The user can change his/her password in the Data Dictionary platform through:

Menu/ Username/ Change Password, as seen in Figure 46.



Figure 46. Change Password

- The user can only view all the other information of the Data Dictionary.
- The user can Log out through:

Menu/ Username/ Logout.

1.1.4.3. MODULE SUPERVISOR

A Module Supervisor can perform all the actions that a Module Programmer can (**for details in Menu navigation see Section 1.1.4.2 Module Programmer**) and additionally they can:

- Introduce a new Symbol that has as main module a module they are in charge of. The new Symbol is validated.
- Associate an existing Symbol to a module they are in charge of.
- Modify all the Symbols associated with modules they are in charge of. After the modification, the Symbols, that have as main module a module they are in charge of, become validated.
- Validate a Symbol that has as main module a module they are in charge of.
- Delete a Symbol that has as main module a module they are in charge of.
- Create a new Index or associate an existing Index to a Symbol associated with modules they are in charge of. The new Index is validated.
- Create or modify an Acronym, an Adjective or a Semantic Rule.
- Only view all the other Symbols that are not associated with modules they participate in.
- Only view all the other information about the Data Dictionary.

A Module Supervisor also receives alerts in the left part of the screen whenever a new pending Symbol, that has as main module a module they are in charge of, is introduced.

VALIDATION AND DELETION OF SYMBOLS

The user can **validate a Symbol** that has as main module a module they are in charge of through:

Menu/ Symbols/ Manage my Symbols: Select a Symbol in list and press "Validate".

There is a restriction in the validation procedure. A Symbol cannot be validated if it is declared as indexed, but no indices are associated with it.

The user can **delete a Symbol** that has as main module a module they are in charge of through:

Menu/ Symbols/ Manage my Symbols: Select a Symbol in list and press "Delete".

There is a restriction in the deletion procedure. A Symbol cannot be deleted if there are secondary modules associated with it.

The validation or deletion of a Symbol can be seen in Figure 47.

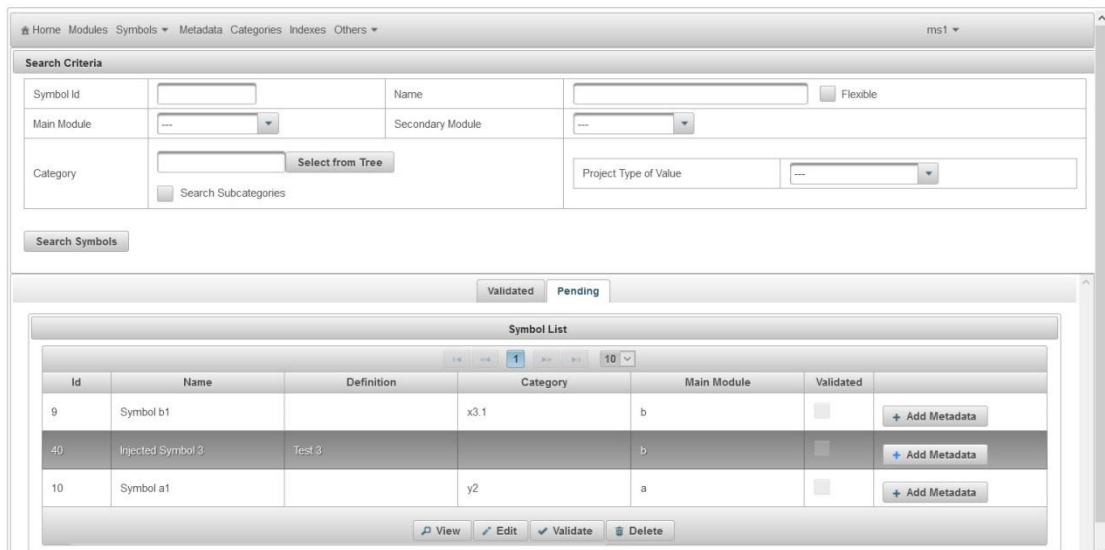


Figure 47. Validate or Delete Symbol

CREATION AND MODIFICATION OF AN ACRONYM, ADJECTIVE OR SEMANTIC RULE

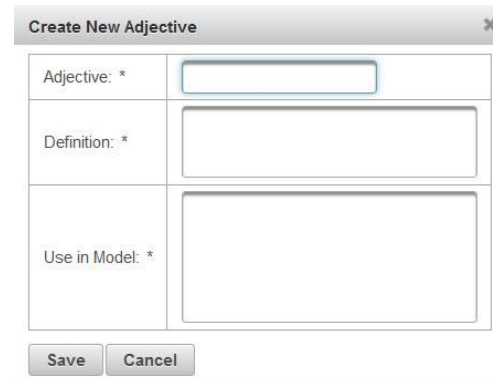
The user can **create or modify an Acronym, an Adjective or a Semantic Rule** through:

Menu/ Others, as it can be seen in Figure 48, Figure 49, Figure 50.



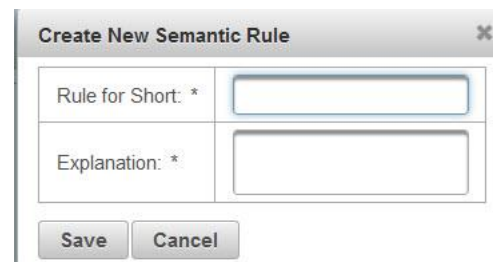
The dialog box titled "Create New Acronym" contains two input fields: "Letters: *" and "Meaning: *". Below the fields are "Save" and "Cancel" buttons.

Figure 48. Create New Acronym



The dialog box titled "Create New Adjective" contains three input fields: "Adjective: *", "Definition: *", and "Use in Model: *". Below the fields are "Save" and "Cancel" buttons.

Figure 49. Create New Adjective



The dialog box titled "Create New Semantic Rule" contains two input fields: "Rule for Short: *" and "Explanation: *". Below the fields are "Save" and "Cancel" buttons.

Figure 50. Create New Semantic Rule

1.1.4.4. GENERAL SUPERVISOR

A General Supervisor can perform all the actions that a Module Programmer and a Module Supervisor can (for details in Menu navigation see the Sections 1.1.4.2 Module Programmer and 1.1.4.3 Module Supervisor), without the restrictions in modules that they have, and additionally they can:

- Introduce a new Symbol that has any module as main module. The new Symbol is validated.
- Associate an existing Symbol to any module.
- Modify all the Symbol attributes in the database. After the modification, the Symbols become validated.
- Validate any Symbol.
- Remove a module as main module of a Symbol and promote a secondary module as main.
- Create a new Index or Category. The new Index or Category is validated.
- Validate an Index or Category.
- Add/modify/delete modules.

- Add/modify/delete the values for Project Type of Value, Programming Language Symbol Type, Unit System, Roles.
- Establish all the necessary matches between Project Types of Value and Programming Language Symbol Types. A Project Type of Value can have as many matches with Programming Language Symbol Types as the user wants and vice versa (it is a many-to-many relationship).
- Delete an object of any entity.
- Manage users. This means they can create a new user assigning him a role and indicating modules in which they participate or are in charge of. They can, also, modify or delete a user.
- Assign new roles and new modules to an existing user or remove a role from him/her.

MODULE MANAGEMENT

The user can **remove a module as Main Module of a Symbol and promote a Secondary Module as the Main Module of the Symbol** through:

Menu/ Symbols/ Manage Symbols: Select a Symbol in list and press "Edit", as seen in Figure 51.

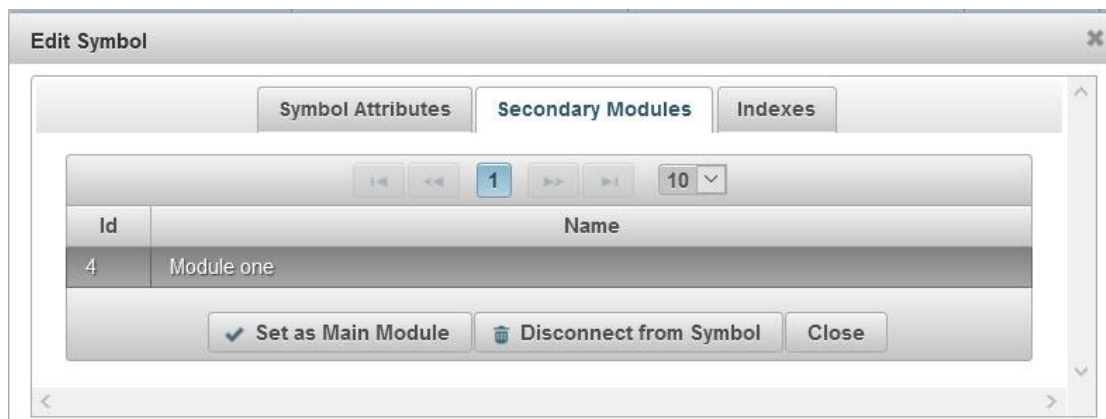
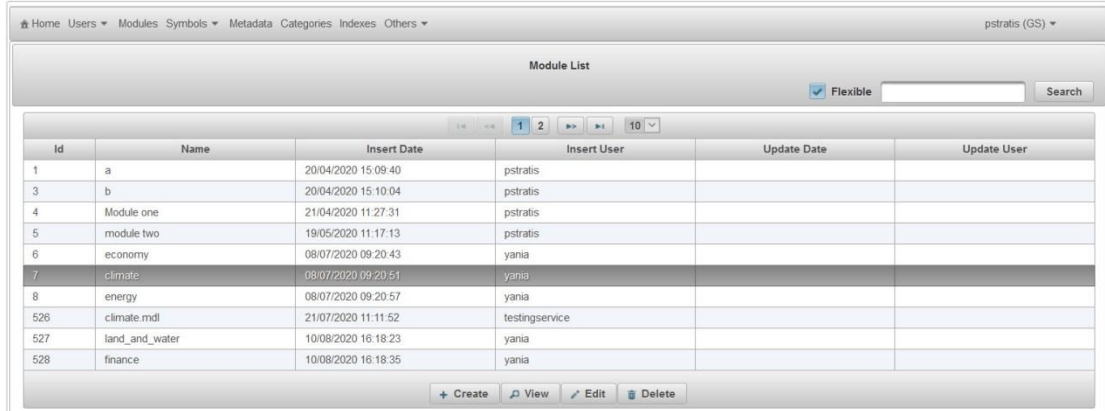


Figure 51. Promote a secondary module as main

The user can **add/modify/delete Modules** through:

Menu/ Modules, as seen in Figure 52.

Deletion of a module is not allowed if there are Symbols associated with it.



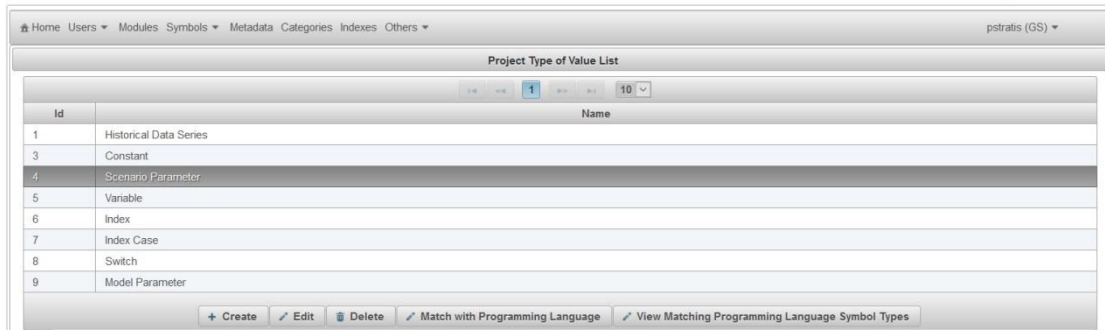
Id	Name	Insert Date	Insert User	Update Date	Update User
1	a	20/04/2020 15:09:40	pstratis		
3	b	20/04/2020 15:10:04	pstratis		
4	Module one	21/04/2020 11:27:31	pstratis		
5	module two	19/05/2020 11:17:13	pstratis		
6	economy	08/07/2020 09:20:43	yania		
7	climate	08/07/2020 09:20:51	yania		
8	energy	08/07/2020 09:20:57	yania		
526	climate.mdl	21/07/2020 11:11:52	testingservice		
527	land_and_water	10/08/2020 16:18:23	yania		
528	finance	10/08/2020 16:18:35	yania		

Figure 52. Module List

CREATION AND MODIFICATION OF PROJECT TYPE OF VALUE, PROGRAMMING LANGUAGE SYMBOL TYPES, ROLES AND UNIT SYSTEM

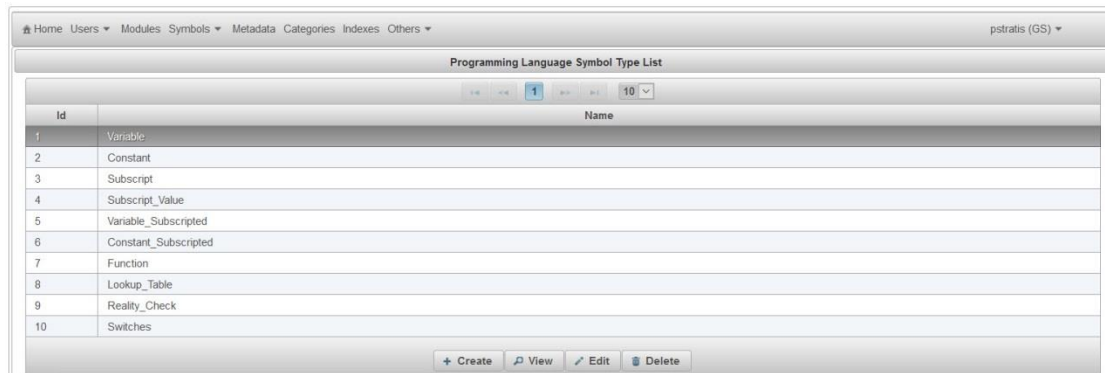
The user can **add/modify the values for Project Type of Value, Programming Language Symbol Types, Roles, Unit System** through:

Menu/ Others, as presented in Figure 53 to Figure 56.



Id	Name
1	Historical Data Series
3	Constant
4	Scenario Parameter
5	Variable
6	Index
7	Index Case
8	Switch
9	Model Parameter

Figure 53. Project Type of Value List



Id	Name
1	Variable
2	Constant
3	Subscript
4	Subscript_Value
5	Variable_Subscripted
6	Constant_Subscripted
7	Function
8	Lookup_Table
9	Reality_Check
10	Switches

Figure 54. Programming Language Symbol Type List

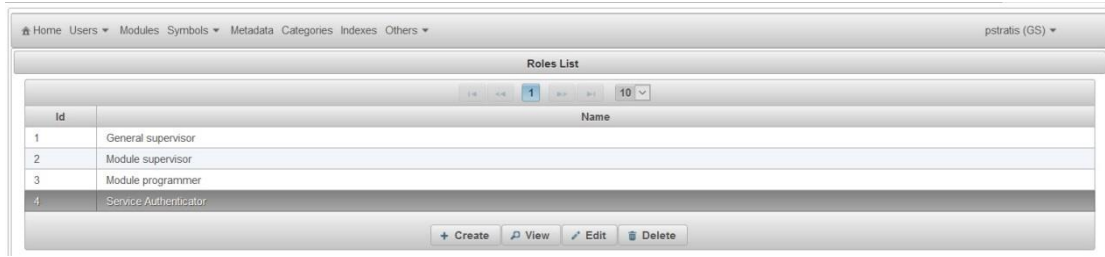


Figure 55. Roles List



Figure 56. Create Unit System

The user must **establish all the necessary matches between Project Types of Value and Programming Language Symbol Types** through:

Menu/ Others/ Project Types Of Value: Select a type in list and press "Match with Programming Language", as seen in Figure 57.

A Project Type of Value can have as many matches with Programming Language Symbol Types as the user wants and vice versa (it is a many-to-many relationship).

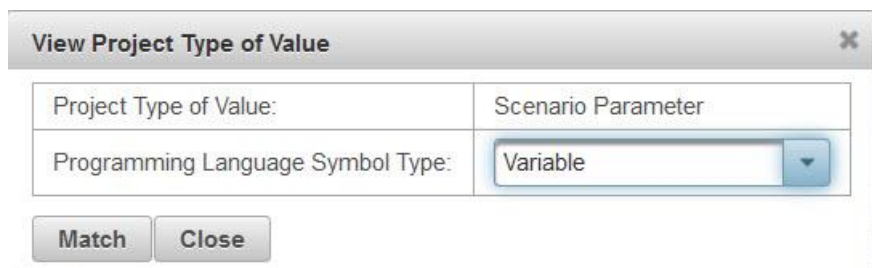


Figure 57. Match Project with Programming Language Symbol Types

The user can **remove a match between a Project Type of Value and a Programming Language Symbol Types** through:

Menu/ Others/ Project Type of Value: Select a type in list and press "View Matching Programming Language Types", then in the pop up window select a Programming Language Type and press "Disconnect from Project Type, as seen in Figure 58.

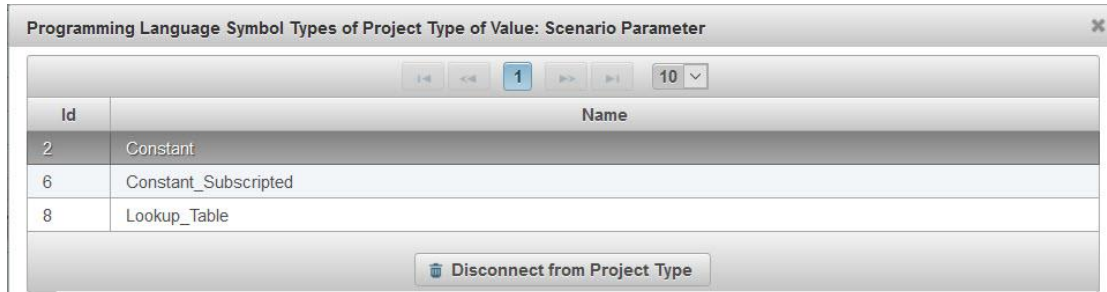


Figure 58. Remove Match between Project with Programming Language Symbol Types

MANAGING USERS

The user can manage other users. This means they can create a new user assigning them a role and indicating modules in which they participate in or are in charge of. They can also modify or delete a user. In the left side of the Users list, there is an arrow, which, when clicked, opens a sub-list with the roles of the corresponding user through:

Menu/ Users/ Manage Users (Figure 59).

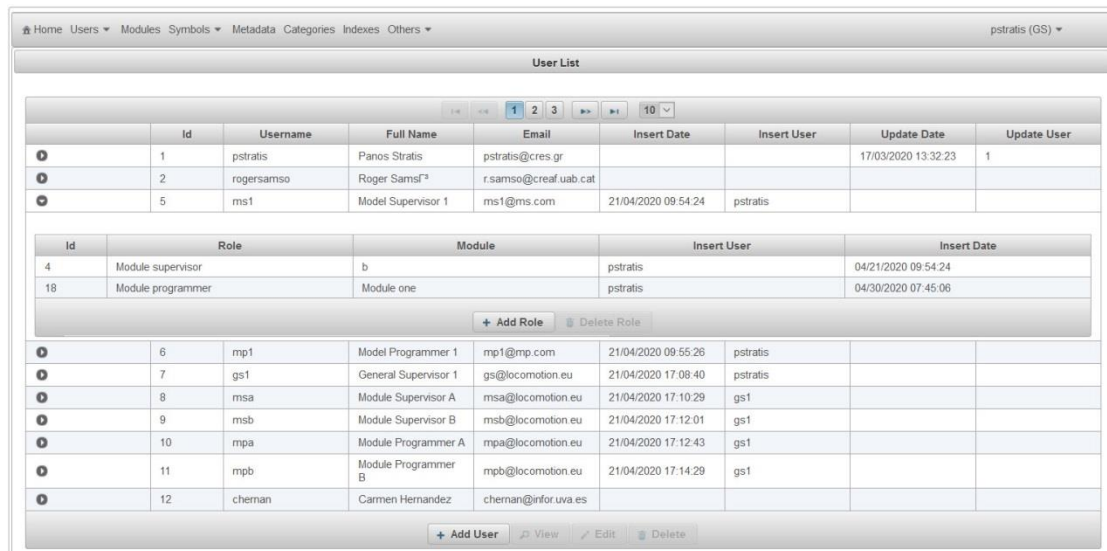
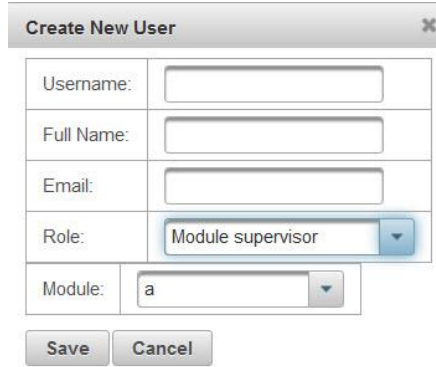


Figure 59. List of Users with Sub-list of Roles of a User



The 'Create New User' dialog box contains the following fields and controls:

Username:	<input type="text"/>
Full Name:	<input type="text"/>
Email:	<input type="text"/>
Role:	<input type="text" value="Module supervisor"/>
Module:	<input type="text" value="a"/>

Buttons: Save, Cancel

Figure 60. Create New User

The General Supervisor can also assign new roles and new modules to an existing user or remove a role from them, as seen in Figure 61.



The 'Add Role to User' dialog box contains the following fields and controls:

User:	<input type="text" value="ms1"/>
Role:	<input type="text" value="General supervisor"/>
Module:	<input type="text" value="Select One"/>

Buttons: Save, Cancel

Figure 61. Add Role to a User

1.2. SYMBOL VALIDATION

The modellers are in charge of validating the Symbols belonging to their module, for which they have the rank of Module Supervisor in the Data Dictionary.

Symbol validation is achieved through the Data Dictionary website, described in detail in Section 1.1 Data Dictionary.

In order to be validated correctly, the Symbols must be automatically uploaded to the Data Dictionary, hence ensuring that the information loaded in the Data Dictionary matches the information in the file .mdl. Both the Symbol in question and the view where it is located must comply with all the nomenclature rules set out in Deliverable 9.1 Report of the common modelling framework (available in https://ecm.cartif.es/share/s/qafi_tOiQGWH1Vtu-XOWcw) (Section 4.2 Naming Conventions).

The automatic injection of Symbols works as follows: when a commit and push is selected in Gmaster, the .mdl file is sent by the GitLab tool to SonarQube, so as to effectuate the analysis. SonarQube exchanges information with the Data Dictionary in order to detect nomenclature errors and missing data in Symbols, such as a Symbol with no units or no comment, and adds the Symbols that meet all the rule requirements to the Data Dictionary. SonarQube also analyses the existing Symbols previously validated. In case of detecting non-matching information between the .mdl file and the Data Dictionary, the tool displays the error with details.

1.2.1. ACTIONS PRIOR TO SYMBOL VALIDATION

The automatic injection of Symbols occurs automatically as long as the Symbol complies with the rules. For this, a plugin for Vensim has been implemented in the SonarQube tool capable of detecting errors to facilitate the search and propose solutions for them. In addition to SonarQube, the Data Dictionary itself has an acronym base, facilitating compliance with naming rules.

1.2.1.1. SONARQUBE

The SonarQube tool (<https://sonarqube-locomotion.infor.uva.es/>) is developed to perform an analysis of the .mdl file. This analysis is done automatically after each commit is uploaded to the GitLab application. SonarQube maintains the same structure of the model with the modules, and the analysis is carried out separately for each module. This means that SonarQube is divided into nine parts and each part shows the unique information of each module (Figure 62).

More detailed information about SonarQube can be found in Deliverable 9.1 Report of the common modelling framework (available in: https://ecm.cartif.es/share/s/qafi_tOiQGWH1Vtu-XOWcw) (Appendix E: About the Vensim plugin for SonarQube)

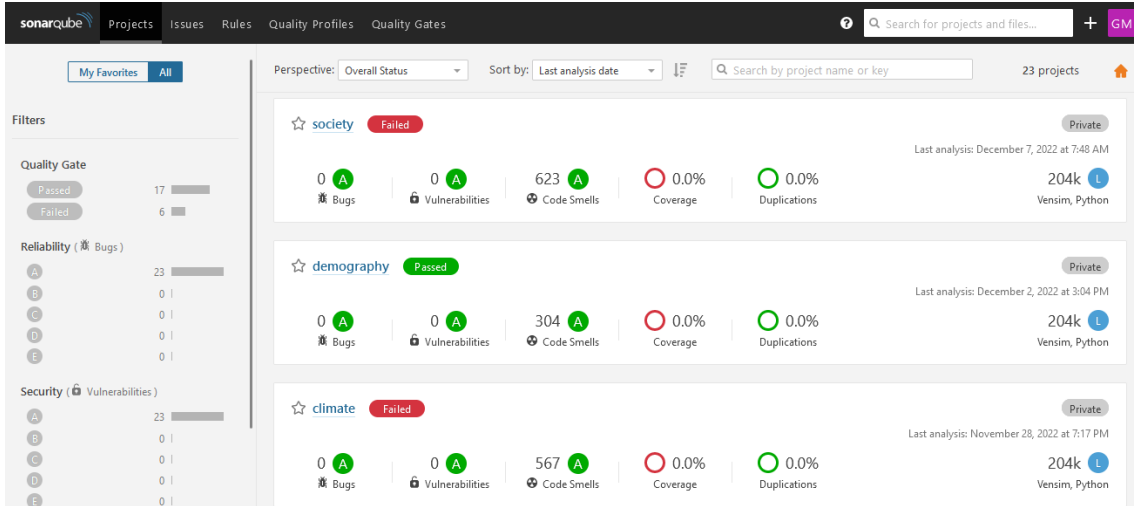


Figure 62. SonarQube Main page

SonarQube shows a list of errors for each module. To view the issues of a module the modellers must select the repository of their module, and press Issues (Figure 63), then select Rule on the right side, where a list of all rules that are not respected in their module is displayed (Figure 64). The modellers can click on each of the rules to be able to see all the Symbols with errors. The modellers can also be informed in more detail about the rules not respected for their module by clicking on See Rule (Figure 65).

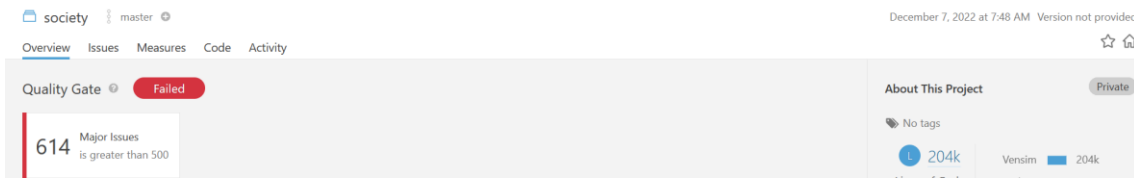


Figure 63. SonarQube Module View

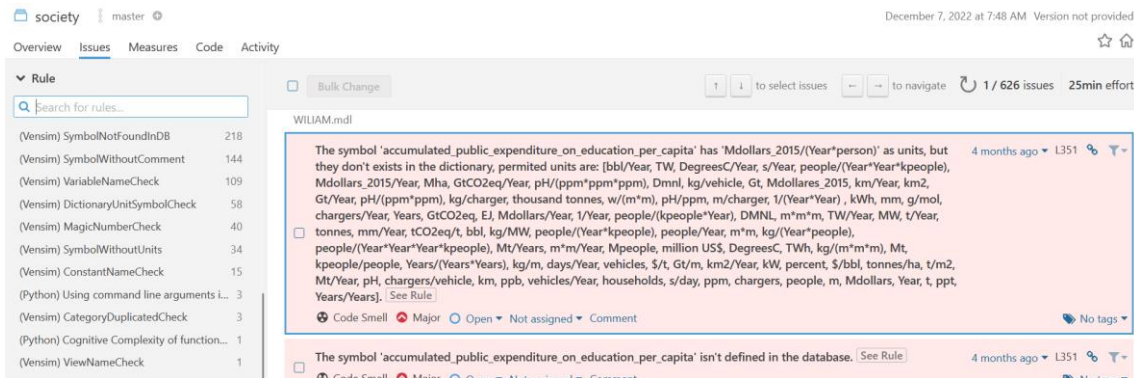


Figure 64. List of SonarQube Issues

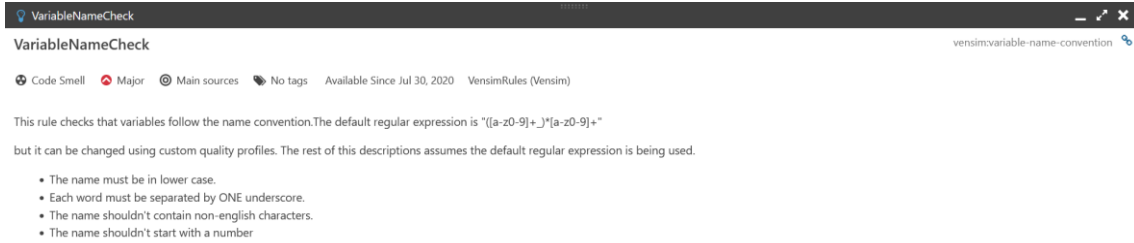


Figure 65. See Rule page

1.2.1.1.1. LIST OF ERRORS DETECTED BY SONARQUBE

SonarQube detects three types of errors:

- errors before the validation phase (not loaded into the Data Dictionary)
- pending validation (shows all the Symbols found in the database pending validation) and
- errors after validation (shows the differences between the information loaded in the database and the information in the .mdl file).

Table 1 presents the list of errors detected in SonarQube by type.

Table 1. SonarQube Vensim rules

	Rule	Explanation
Before validation	CategoryDuplicatedCheck	There are at least two categories with the same name.
	ConstantNameCheck	The name of the constant does not follow the rules.
	DelayedVariableNameCheck	The name of the delayed variable does not follow the rules.
	EmbeddedLookupCheck	The lookup values must come from excel file.
	LookupNameCheck	The name of the lookup does not follow the rules.
	MagicNumberCheck	The symbol has magic numbers.
	RealityCheckNameRule	The name of the reality check does not follow the rules.
	DictionaryUnitSymbolCheck	The unit is not in the unit database.
	SubscriptNameCheck	The name of the subscript does not follow the rules.
	SymbolWithoutComment	The symbol has no comment.
	SymbolWithoutUnits	The symbol has no units.
	VariableNameCheck	The name of the variable does not follow the rules.
ViewNameCheck	The name of the view does not follow the rules.	
Pending validation	SymbolNotFoundInDB	Symbol pending validation.

	Rule	Explanation
After validation ¹	DictionaryCommentMismatch	The symbol, once validated, has had changes in the comment.
	DictionaryIndexMismatch	The symbol, once validated, has had changes in the subscripts associated with it.
	DictionarySymbolExcelRefCheck	The symbol, once validated, has had changes in the excel path.
	DictionaryUnitsMismatch	The symbol, once validated, has had changes in the units.

The user can view all the errors and the rules that are associated with each error in the following link: https://sonarqube-locomotion.infor.uva.es/coding_rules?activation=true&qprofile=AXOfhF8X2CxLD-ZIAslW.

1.2.2. SYMBOL VALIDATION IN THE DATA DICTIONARY

All Symbols pending validation are listed in the Data Dictionary. The user can access the Symbols database in the Data Dictionary (Figure 66), through:

Menu/ Symbols/ Manage my Symbols

In this page, the user can view, modify and validate all the Symbols associated with the modules they participate in. Symbols are shown in two different tabs, based on their validation status, i.e. whether they are validated or not (pending).

The user can use search criteria to filter the Symbols. These criteria include the Symbol ID, the Symbol name, the main or the secondary module of the Symbol, the Symbol category and the Project Type of Value of the Symbol. In case the search is done based on the Symbol Name, the results can be flexible depending on whether the Symbol name matches exactly or partially the searched text.

¹ This function is pending implementation, currently it is not able to distinguish the differences and it marks all the Symbols with error.

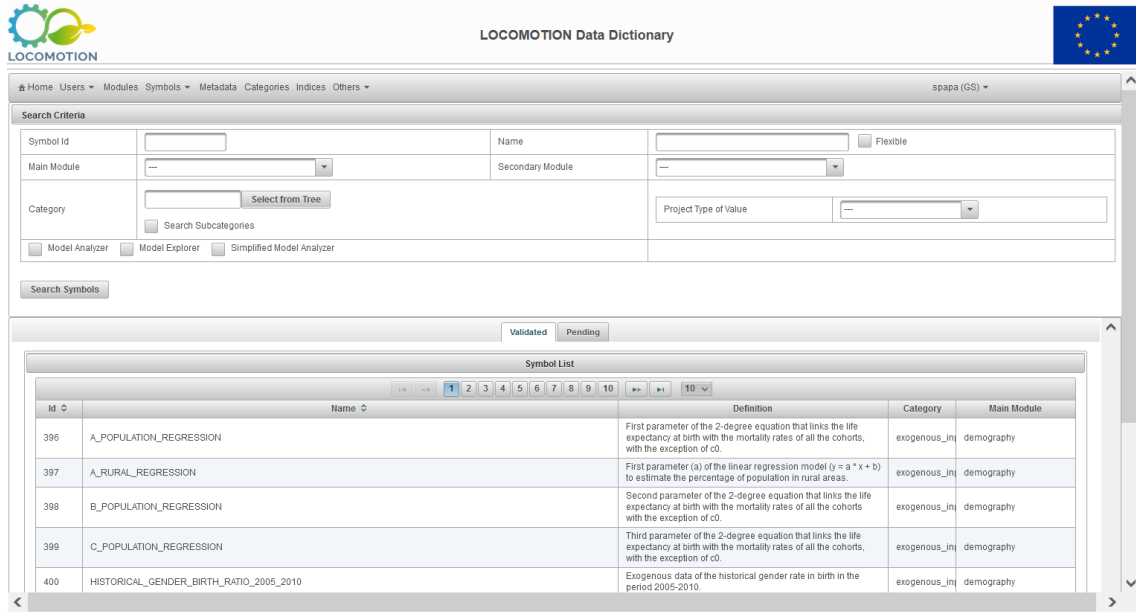


Figure 66. Manage Symbols page

1.2.2.1. EDIT SYMBOL

To validate a Symbol, the user must first edit the Symbol. To do this the user must select the Symbol and press "Edit". As a result a window opens (Figure 67). The editing window opens the Symbol Attributes, where the general information of the Symbol appears (name, definition, unit, category, etc.). The user has to select manually the Project type of Value from a drop down menu, choosing between the different existing options.

The user can access the list of Project Type of Values and their definitions through:

Menu/ Others/ Project Type of Values

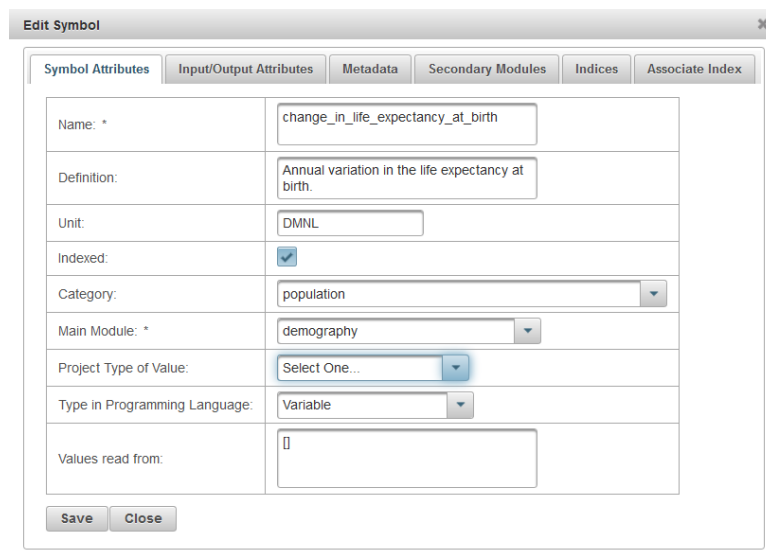


Figure 67. Edit Symbol – Symbol Attributes

If the Symbol in the model has associated subscripts, the Indexed box is checked automatically. This box forces the user to associate indices (i.e., subscripts in the Data Dictionary) in order to have the option to validate the Symbol.

To associate an index, within the Edit Symbol window the user can press on “Associate Index”, where a list of all the indices that the associated model has is displayed and the user has to choose the index/indices that are used in their Symbol, select the index and press “Select”. This action must be repeated for each of the indices (Figure 68).

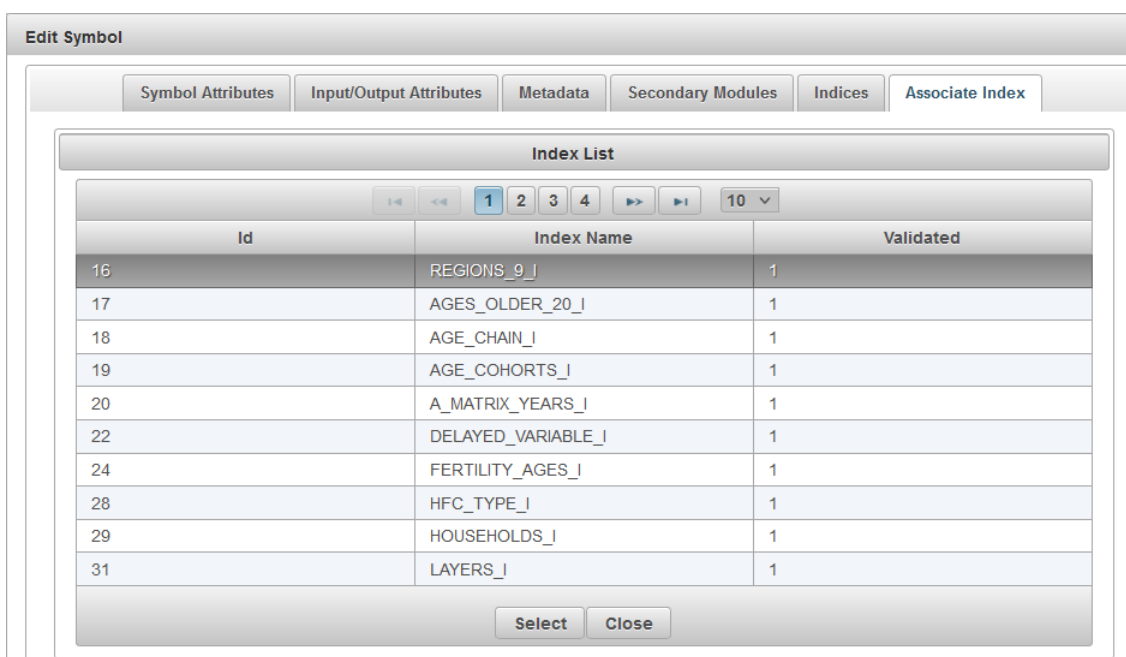


Figure 68. Edit Symbol - Associate Index

Once the user has associated the indices, they can view them by clicking on the “Indices” tab. In this window the user can also disconnect an index from the Symbol in case they have associated it wrongly. For this the user can select the index they want to delete and press on the “Disconnect from Symbol” button (Figure 69).

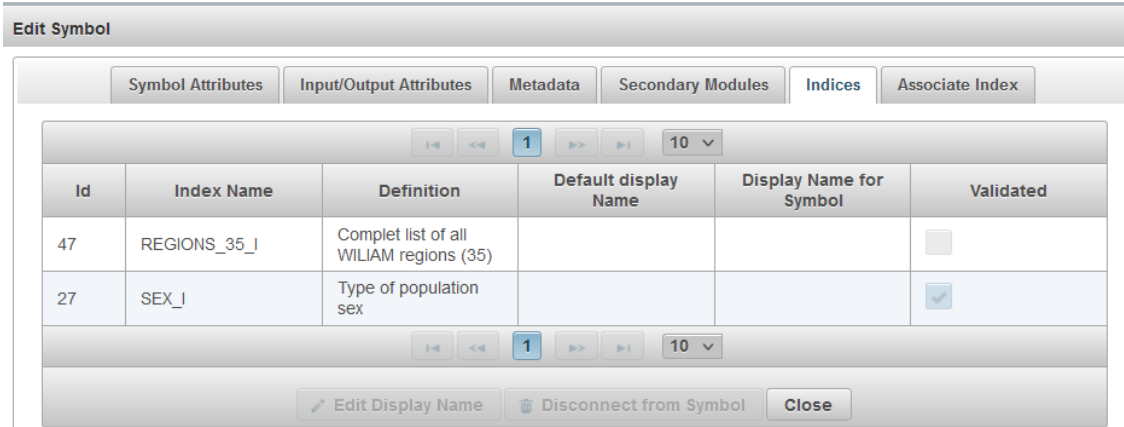


Figure 69. Edit Symbol - Indices

Only if the Project type of the Symbol value is a variable or a scenario parameter (SP) the “Input/Output Attributes” tab appears, as it can be seen in Figure 70. The user can choose between the 3 types of model:

- **Model Analyzer:** Accept all variables and scenario parameters, but avoid selecting such large matrices as Scenario Parameters. Use the same matrix but with reduced dimensions instead (e.g., same value for all sectors, same value for all regions or same value for all regions and sectors).
- **Simplified Model Analyzer:** Accept all variables and scenario parameters, with the condition to have dimensions a little smaller than those in the model analyzer (vector or small matrix).
- **Model Explorer:** Accept just scenario parameters with one value.

The user can also choose if they want the Symbol to appear on the web and define the display name that appears in the corresponding application (Data Client).

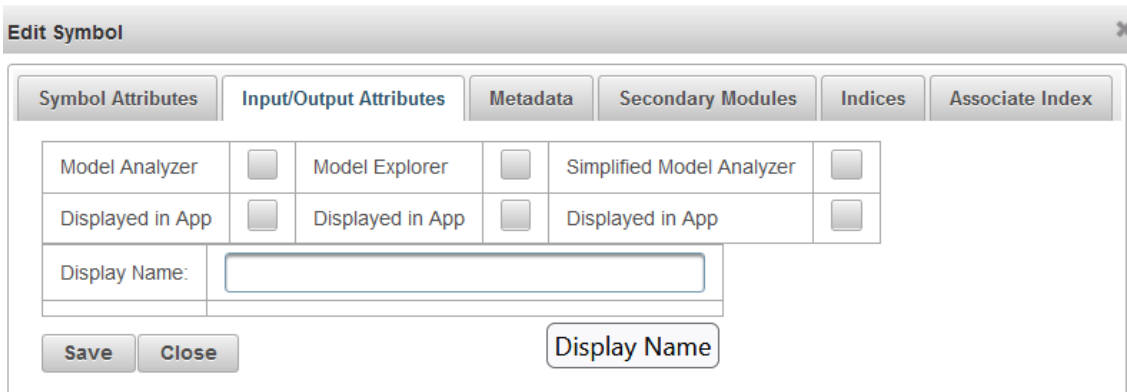


Figure 70. Edit Symbol - Input/Output Attributes

All the Symbols have to be associated to Metadata (Figure 71).

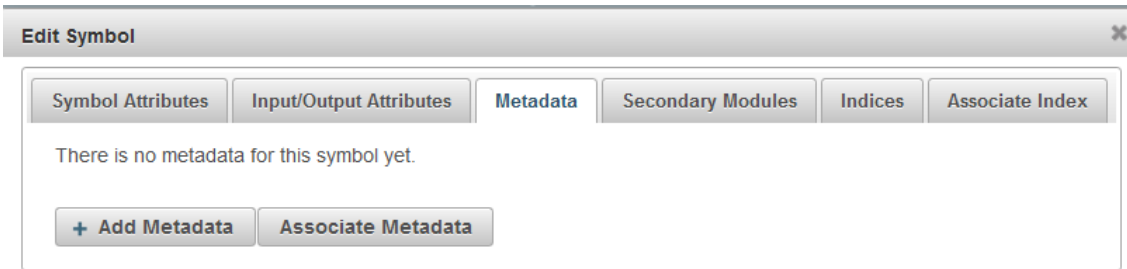
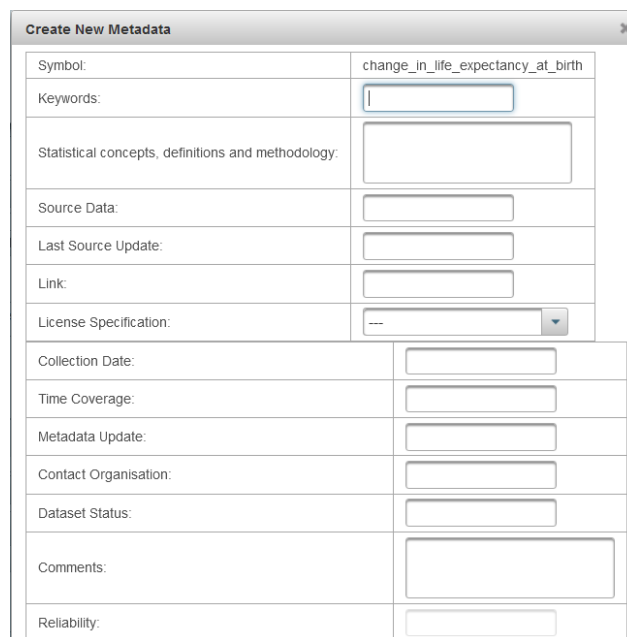


Figure 71. Edit Symbol - Metadata

There are two options to add Metadata to Symbols. The first option is to add the Metadata manually. The user should enter information on all the metadata fields required in the metadata document “Guidelines to describe the uncertainty of the WILLIAM input parameters”, available in: https://ecm.cartif.es/share/s/6lc14PnwTe6l_9H2I3yMyQ. A detailed description of the Metadata fields is available in Annex I. Description of the metadata fields.

When the user presses “Add Metadata”, a new window is displayed (Figure 72) where the user must fill in all the data. Once all the data is entered, the user has to press “Save”.



Symbol:	change_in_life_expectancy_at_birth
Keywords:	<input type="text"/>
Statistical concepts, definitions and methodology:	<input type="text"/>
Source Data:	<input type="text"/>
Last Source Update:	<input type="text"/>
Link:	<input type="text"/>
License Specification:	---
Collection Date:	<input type="text"/>
Time Coverage:	<input type="text"/>
Metadata Update:	<input type="text"/>
Contact Organisation:	<input type="text"/>
Dataset Status:	<input type="text"/>
Comments:	<input type="text"/>
Reliability:	<input type="text"/>

Unbiased:	<input type="checkbox"/>
Author credibility:	<input type="checkbox"/>
Objectivity:	<input type="checkbox"/>
Accuracy & reliability: Description:	<input type="checkbox"/>
Accuracy & reliability: Units:	<input type="checkbox"/>
Currency & timeliness: Dates:	<input type="checkbox"/>
Currency & timeliness: Current:	<input type="checkbox"/>
Uncertainly:	<input type="text"/>
No statistical descriptors added:	<input type="checkbox"/>
Type of input data:	Select one <input type="button" value="v"/>

Save Cancel

Figure 72. Add Metadata

The other option to add Metadata to a Symbol is by clicking on “Associate Metadata”. A window is displayed where all the information already collected in a spreadsheet file appears (Figure 73), the user only has to select the dataset and press on “Associate”. The Symbol has the metadata associated with it.

Associate Metadata with Symbol: change_in_life_expectancy_at_birth

Search Criteria

Dataset Name

Source

List

(1 of 28)

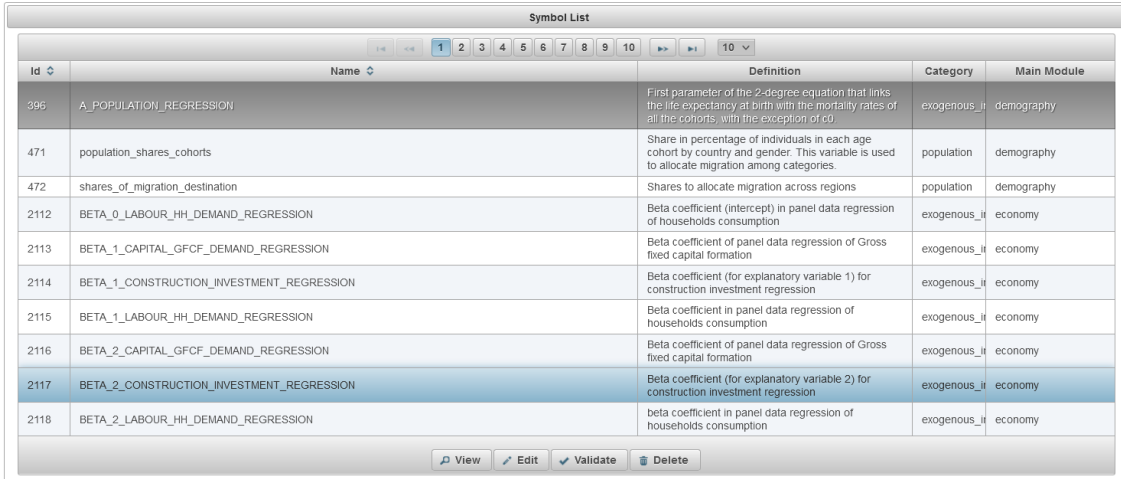
Id	Dataset Id	Dataset Name	Project Type of Value	Source Data	Collection Date	License Specification	License Specification Details
1	1	Agricultural commodities breakdown by use (food, feed, biofuel use, other use)	Historical data series	OECD-FAO Agricultural Outlook 2019-2028	28/01/2020		
2	2	Agricultural commodities breakdown by use (food, feed, biofuel use, other use)	Historical data series	OECD-FAO Agricultural Outlook 2019-2028	28/01/2020		
		Land use by	Historical data	Food and Agriculture Organization of the United			CC BY NC SA

Figure 73. Associate Metadata

All datasets are uploaded from the online spreadsheet file created by CRES “Metadata template”, which is available via the shared link:

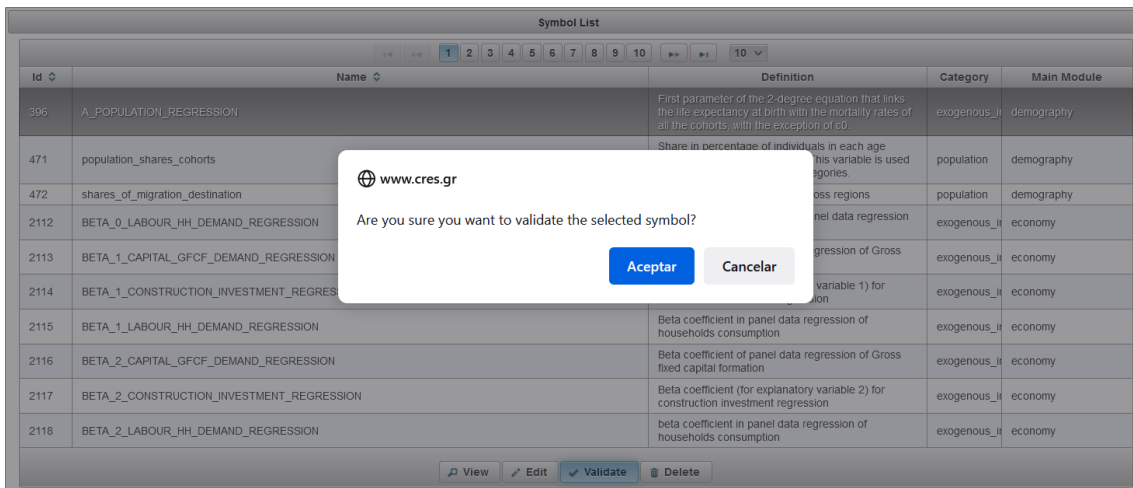
<https://docs.google.com/spreadsheets/d/1HLp4XyXoumgw8rahR8SRxvVN2R9BSjRAD9AJepWVfVM/edit#gid=712108022>

Once the user has done all the previous steps, they can return to the Symbol Attributes window and click on Save. All the changes the user has made to the Symbol will be saved and only then the user can validate the Symbol. To validate the Symbol, the user must select it and click on Validate. A window is displayed, asking if the user is are sure they want to validate the selected Symbol. The user needs to click on “Accept” (Figure 75). Next, the Symbol disappears from the pending list and goes to the list of validated. A message also appears in the upper right corner of the screen informing the user that the validation of the Symbol has been successfully completed (Figure 76).



Id	Name	Definition	Category	Main Module
396	A_POPULATION_REGRESSION	First parameter of the 2-degree equation that links the life expectancy at birth with the mortality rates of all the cohorts, with the exception of c0.	exogenous_it	demography
471	population_shares_cohorts	Share in percentage of individuals in each age cohort by country and gender. This variable is used to allocate migration among categories.	population	demography
472	shares_of_migration_destination	Shares to allocate migration across regions	population	demography
2112	BETA_0_LABOUR_HH_DEMAND_REGRESSION	Beta coefficient (intercept) in panel data regression of households consumption	exogenous_it	economy
2113	BETA_1_CAPITAL_GFCF_DEMAND_REGRESSION	Beta coefficient of panel data regression of Gross fixed capital formation	exogenous_it	economy
2114	BETA_1_CONSTRUCTION_INVESTMENT_REGRESSION	Beta coefficient (for explanatory variable 1) for construction investment regression	exogenous_it	economy
2115	BETA_1_LABOUR_HH_DEMAND_REGRESSION	Beta coefficient in panel data regression of households consumption	exogenous_it	economy
2116	BETA_2_CAPITAL_GFCF_DEMAND_REGRESSION	Beta coefficient of panel data regression of Gross fixed capital formation	exogenous_it	economy
2117	BETA_2_CONSTRUCTION_INVESTMENT_REGRESSION	Beta coefficient (for explanatory variable 2) for construction investment regression	exogenous_it	economy
2118	BETA_2_LABOUR_HH_DEMAND_REGRESSION	beta coefficient in panel data regression of households consumption	exogenous_it	economy

Figure 74. Symbol List - Validate



Id	Name	Definition	Category	Main Module
396	A_POPULATION_REGRESSION	First parameter of the 2-degree equation that links the life expectancy at birth with the mortality rates of all the cohorts, with the exception of c0.	exogenous_it	demography
471	population_shares_cohorts	Share in percentage of individuals in each age cohort by country and gender. This variable is used to allocate migration among categories.	population	demography
472	shares_of_migration_destination	Shares to allocate migration across regions	population	demography
2112	BETA_0_LABOUR_HH_DEMAND_REGRESSION	Beta coefficient (intercept) in panel data regression of households consumption	exogenous_it	economy
2113	BETA_1_CAPITAL_GFCF_DEMAND_REGRESSION	Beta coefficient of panel data regression of Gross fixed capital formation	exogenous_it	economy
2114	BETA_1_CONSTRUCTION_INVESTMENT_REGRESSION	Beta coefficient (for explanatory variable 1) for construction investment regression	exogenous_it	economy
2115	BETA_1_LABOUR_HH_DEMAND_REGRESSION	Beta coefficient in panel data regression of households consumption	exogenous_it	economy
2116	BETA_2_CAPITAL_GFCF_DEMAND_REGRESSION	Beta coefficient of panel data regression of Gross fixed capital formation	exogenous_it	economy
2117	BETA_2_CONSTRUCTION_INVESTMENT_REGRESSION	Beta coefficient (for explanatory variable 2) for construction investment regression	exogenous_it	economy
2118	BETA_2_LABOUR_HH_DEMAND_REGRESSION	beta coefficient in panel data regression of households consumption	exogenous_it	economy

Figure 75. Secure validation page

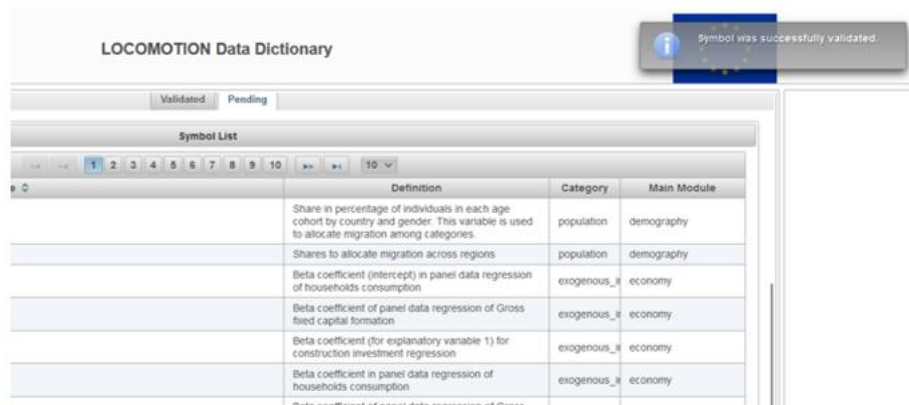


Figure 76. Symbol was successfully validated page

1.2.3. EDITING VALIDATED SYMBOLS

It is possible that once a Symbol is already validated, the information in the .mdl file is updated and the information between the validated Symbol in the Data Dictionary and the information of the Symbol in the .mdl file does not match. To update the information in the Data Dictionary with the new information of the Symbol in the model the user must distinguish whether the information was entered automatically in the Symbol (name, comment, path to excel, etc.) or it was added manually when editing the Symbol in the step prior to validation. In the first case, the user must look for the Symbol in question in the Data Dictionary, select it and click on edit and then click on save, so that the Symbol is no longer in the validated Symbols tab and goes to the tab of Symbols pending validation. Once the Symbol is back in the pending tab, the user must make a new commit so that SonarQube can perform a new analysis and automatically update the information on the Symbol. Once the Symbol is updated with the new data, the user must go back to click on edit and check that everything is correct. Once this is verified the user can click on the validate button in the lower part. For the second case, if the information was added manually to the Symbol, such as the subscripts or the input/output, the user must make the change manually, as they did in the previous case, then they must look for the Symbol and click on edit, where the information is displayed and the user can update the information manually. After that the user should save before closing. The Symbol goes to the pending tab where the user must look for it, select it and then start the validation process.

1.3. WILIAM DATABASE OF SELECTED SIMULATED SCENARIOS AND RESULTS

1.3.1. ACCESS TO THE WILIAM DATABASE OF SELECTED SIMULATED SCENARIOS AND RESULTS AND MAIN PAGE

The aim of the WILIAM Database of selected simulated scenarios and results is to be used as an instrument for dissemination of the results of WILIAM.

On one hand, the database includes all the necessary information on the narrative description of the selected storylines and selected simulated scenarios in the WILIAM model, as well as the input parameters of each of these selected simulated scenarios. On the other hand, the database includes the main scenario outputs, i.e., the results of each selected simulated scenario of the WILIAM model and the timeline series of the future projection values for selected (the most relevant) output variables.

The selection of storylines and simulated scenarios that is used as input in this part of the database was based on Deliverable 9.3 Synthesis of the model, selected results and scenario assessment and a set of additional model runs, while the selection of the most relevant output variables was done in collaboration with the modellers.

The web application of the Database of the main output variables of WILIAM is currently hosted in CRES with URL: http://www.cres.gr/LOCOMOTION_scenarios and it is also available in the LOCOMOTION project website with URL: <https://www.locomotion-h2020.eu/locomotion-models/database/>.

In the main page, the user has two options in order to proceed:

- 1) The first is to proceed to the Public View as a non-registered user. This option is available for external users to the LOCOMOTION project.
- 2) The second is to Log in with the credentials already available in the Data Dictionary. This option is only available for the LOCOMOTION groups in order to allow the creation, maintenance and editing of the data availability in the Database.

The main page of the WILIAM Database of selected simulated scenarios and results is presented in Figure 77Figure 18.



Figure 77. Main page of the WILIAM Database of selected simulated scenarios and results

1.3.2. MAIN ENTITIES OF THE DATABASE OF SELECTED SIMULATED SCENARIOS AND RESULTS

The main entities included in the Database of selected simulated scenarios and results are presented below.

The main entities included in the narrative description part of the database include:

1.3.2.1. STORYLINES

This entity includes the different storylines on which modellers are based in order to run different scenarios. The storylines selected in WILLIAM and the main keywords/features identifying each storyline, according to Deliverable 8.3 (Markovsa, 2021), are presented in detail below:

- **SSP 2 “Middle of the road” (O’Neill et al., 2017)**

The world follows a path in which social, economic, and technological trends do not shift markedly from historical patterns. Development and income growth proceeds unevenly, with some countries making relatively good progress while others fall short of expectations. Most economies are politically stable. Globally connected markets function imperfectly. Global and national institutions work toward but make slow progress in achieving sustainable development goals, including improved living conditions and access to education, safe water, and health care. Technological development proceeds apace, but without fundamental breakthroughs. Environmental systems experience degradation, although there are some improvements and overall the intensity of resource and energy use declines. Even though fossil fuel dependency decreases slowly, there is no reluctance to use unconventional fossil resources. Global population growth is moderate and levels off in the second half of the century as a consequence of completion of the demographic transition. However, education investments are not high enough to accelerate the transition to low fertility rates in low-income countries and to rapidly slow population growth. This growth, along with income inequality that persists or improves only slowly, continuing societal stratification, and limited social cohesion, maintain challenges to reducing vulnerability to societal and environmental changes and constrain significant advances in sustainable development. These moderate development trends leave the world, on average, facing moderate challenges to mitigation and adaptation, but with significant heterogeneities across and within countries”.

- **Green Growth (GG)**

Green Growth aims at achieving low carbon systems in combination with sustained increases in consumption under a convergence scheme: low-income countries would plan a faster economic growth in order to progressively catch up with richer countries, which would also continue to plan to grow albeit at a slower pace. Green Growth is about the generalization of the western life standards (i.e. attaining their consumption level of goods and services) to all inhabitants of the globe, but significantly reducing the environmental footprint. This growth would happen simultaneously to a global agreement to reduce GHG emissions through the deployment of new low carbon technologies fast enough to contain global temperature increase in the range of +1.5-2°C. It would require all nations to participate with nationally determined contributions (NDCs) consistent with the Paris Agreement’s goals. Green Growth matches with global capitalism, and regulation for enforced policies would aim at promoting low carbon technologies (renewables, carbon capture technologies, nuclear, etc.) and removing fossil fuel incentives (that create inertia in markets, media, education, politics, which keep the fossil industry alive), through

mainly market tools such as carbon pricing or private-public partnerships to mobilize investments. These measures would bring absolute decoupling of GDP growth from material throughput/environmental impacts in general, and from carbon emissions in particular by using energy transition as a contributor to GDP growth. Green Growth is mainly a technological transition, with lower relevance for voluntary lifestyle changes focused on reducing the environmental footprint. Indeed, it mainly fosters energy saving innovations and automation to increase labour productivity. This direction of investments is made explicit by the so-called *Next Production Revolution* (OECD, 2017) that includes a variety of digital technologies, industrial biotechnology, 3D printing, new materials and nanotechnology. All these innovations are considered valuable as long as they can generate higher profits, while the impact on society and employment is barely discussed.

Green Growth will benefit from the current urbanisation trends as cities ease sector coupling (by integration of power, heat, cooling, transport, water and synthetic fuels, efficiencies may be improved by using excess from one sector as useful input to the other by factor 2+). Use of intensive agriculture would leave more space to nature, although its environmental impacts on other planetary boundaries (e.g., eutrophication) should also be controlled. Indoor pollution will improve significantly with proper exhaust of fumes or electrification of cooking and heating. Electrification of transport may bring self-driven vehicles, for which there will be no ownership incentives hence allowing to maintain mobility while reducing the total number of vehicles and associated environmental impacts.

This storyline has historically been promoted by institutions such as the OECD, the UNEP, the World Bank and the EU Commission (although the latter has recently shifted to a Green Deal storyline) (European Commission, 2011; Jacobs et al., 2012; OECD, 2011; UNEP, 2011; World Bank, 2012).

Key-words: economic growth, absolute decoupling, global economic convergence; fast diffusion of low carbon technologies, sector coupling, efficiency improvements.

Similar to: SSP1 storyline in baseline mode and all SSPs in policy mode.

- **Green Deal (GD)**

While climate change is one of the most important problems that the global community faces, there are many other simmering and equally significant global challenges. Despite the significant decrease in extreme poverty and inequality on the global level between countries in the last two decades, mostly due to income growth in China and India (“elephant curve” by Milanovic), there has also been a trend towards greater inequality of individuals in many countries (Piketty, 2017). This has created other problems, like a feeling of disenfranchising by the middle classes in high-income countries, which has brought about an anti-globalist backlash. To get these people on board with the transition process, there is a progressive proposal to tackle social inequality simultaneously to environmental challenges. “Green Deal” expression is reminiscent of the USA “New Deal” program characterized by government interventions and a welfare state which successfully counteracted the 1930s recession towards a period of prosperity (which was consolidated after the Second World War and with the Marshall plan in Europe which had also a strong globalization trend, for instance, by removing trade-related barriers).

Although different approaches for a Green Deal are being proposed and debated, a commonly recognized feature is the need for an interventionist economic approach embracing command-and-control regulations, thus limiting the primacy of market-based environmental policy instruments. Public intervention would be directed to set up an extensive welfare state (or expand if already existing) with high levels of social protection (e.g., guaranteeing jobs, health services, education and housing to all), as well as promoting decarbonisation through indicative planning as e.g., industrial policies and public investments, including in some proposals socializing (at least part of) the energy sector to allow for longer

investment horizons and help coordinating public & private initiatives. Green Deal proposals generally consider economic growth as positive to achieving environmental and social objectives, hence being alienated with decoupling narratives (Pollin, 2019). To tackle the social crisis due to increasing inequality, further accentuated by the current pandemic, several radical social policies have also been proposed (Ashford et al., 2020; Mastini et al., 2021): working time reduction, universal basic income, expanding the welfare state by providing free health care and affordable housing to all citizens, creating high-quality union jobs and offering training for workers affected by the transition, and broadening worker ownership. Hence, such interventions do not simply aim at redistributing monetary incomes but rather to change the structure “by redistributing economic and political power” (The Economist, 2019). Within this context falls the concept of “Just Transition” and “do not leave anybody behind”. The strategy would be mainly directed top-down, and despite the fact that it has been popularized mainly in the USA and EU (again with significant heterogeneity), it could in principle be applied to the rest of the regions of the world. However, it should be considered that regional implementation in different countries’ context starts from very different levels of welfare state development, so the pursuit of similar goals might also imply policy goals with varying degrees of policy ambition across countries.

Key-words: social inequality reduction; public investments; welfare state; public ownership of energy utilities; social and labour reforms; job guarantee.

Similar to: Recent proposals from EU Commission “Green Deal” (European Commission, n.d.) and “Green New Deal” from left-wing USA democrats (Sanders, n.d.).

Comments on Green Deal storyline implementation

The heterogeneity of the different Green Deals proposed represents a challenge for the implementation of this storyline as “a unique archetype storyline” in WILIAM. It has been noted that the EU Green Deal may not be so conceptually different from the Green Growth (Ossewaarde and Ossewaarde-Lowtoot, 2020). However, interpreting Green Deal like a Green Growth with additional social policies has the advantage of clearly identifying the additional value-added of implementing these social policies. Also, important to note that we will have to be able to reproduce a Green Deal as the one proposed for the EU at least for the EU region, and we may have different interpretations of the GD storyline in different WILIAM regions.

- **Post-growth (PG)**

Three main reasons motivate skepticism towards achieving absolute decoupling between economic activity and material throughput/environmental impacts as proposed in the Green Growth and Green Deal proposals and motivate Post-growth proposals: (1) historically increases in affluence have generally driven increases in environmental impacts (Haberl et al., 2020), (2) widespread rebound effects present in growth-economies have been proven to counterbalance efficiency improvements to a great extent (Freire-González, 2017) and (3) likely future scarcity of some key materials and natural resources, especially in the context of decreasing marginal returns due to attempts to further expand the economic system in an already degraded biosphere (Hickel and Kallis, 2019). In this storyline, economic growth after a threshold in terms of GDPpc levels and income (much lower than those attained by so-called most high-income countries) is regarded as a major driver that perpetuates rather than enhances sustainability and yackles social issues (Easterlin paradox). Similarly, international trade is identified as a mechanism for unfair exchange and outsourcing of environmental impacts to the poorest countries which overtakes its benefits in terms of technological diffusion through global markets. The proposal of this storyline is more “high-income country”-centred (although it also derives from “low-income country” conceptual roots (Gerber and Raina, 2018) given that globally, ~20% of the population which generally live in the richest countries where the correlation between economic activity/material throughput and well-being is long-

ago broken; this minority is broadly responsible for ~80% of the resource consumption and environmental impacts globally. Inequality reduction both between and within countries is a major goal of this storyline. International convergence would be achieved by high-income countries/people downscaling the size of their material throughput and environmental footprint (what has been termed as “Degrowth” in the literature) to make room for poorest countries/people to increase theirs to cover/achieve basic human needs. Sustainable steady state is the ultimate objective on the global level (Kerschner, 2010). Who and how much to increase/decrease the size of their material throughput will ultimately be an output of the simulations performed with the model, critically dependent on the policy scenario setting (e.g., cf. Capellán-Pérez, Mediavilla, de Castro, Carpintero, & Miguel (2015)). Average material throughput reduction in high-income countries would not necessarily translate into reductions for the entire population, given significant inequalities within those.

Post-growth can hence be defined as “the transition – via the gradual and equitable downscaling of material throughput– to a quantitatively smaller and qualitatively different economy (including out-of-market policies) that respects the environment, increases human well-being and aims at social equity” (Demaria et al., 2013; Schneider et al., 2010). Decisions on downscaling material throughput through reduced demand of goods and services are taken collectively through democratic processes. Emphasis on efficiency is turned towards emphasis on sufficiency to avoid rebound effects. Emphasis is put into behavioural rather than technological changes (“Assessing the degrowth discourse,” 2017). The approach aims to boost the diffusion of already existing technologies globally -which are assessed to be sufficiently developed - to achieve the sustainability transition, rather than on developing new technologies (Millward-Hopkins et al., 2020). This storyline requires a fundamentally different economic system which does not need to constantly grow (in GDP terms) to be viable, and which abandons profit as the main motive for businesses. Because of the deep systemic change and reconfiguration, Post-growth is different to recessions experienced in the current GDP growth oriented economic systems. Despite the reality that to date all modern economies rely on the growth motive, recent work focuses on the barriers which would need to be removed (Richters and Siemoneit, 2019) and the new foundations which would need to be set up (e.g., Tim Jackson (n.d.); Lange (2018); Victor (2019)). In any case, as history shows, the theoretical principles and rules of any new economic system need to be progressively adjusted and adapted with cumulated practice and experience, as it has historically been done when shifting to a new economic paradigm. Reduced material footprint would be achieved through lower demand with structural measures such as reduced working time which together with the set-up of a sharing economy would increase social and political activities Hence, the strategy in this storyline would be a combination of top-down and bottom-up. This storyline could also be consistently applied to low-income countries given that they are also affected by internal inequalities and tend to follow the growth-western-centred development paradigm; e.g Gerber & Raina (Gerber and Raina, 2018) by proposing to merge “Degrowth” proposals with post-development theories, exemplified by the case of Bhutan which has already incorporated elements of a post-growth program. Innovative work is already being developed to implement Post-growth scenarios in combination with overall goals (Svenfelt et al., 2019).

Key-words: relocation, sharing economy, self-organization, commons, conviviality, voluntary measures; democratic downscaling.

Similar to: DiEM25 “Green New Deal for Europe” (DiEM25, n.d.). Terminology here is very confusing, as illustrated by e.g., Mastini, Kallis & Hickel (2021) study focusing on “A Green New Deal without growth”. For WILLIAM, we propose to group non-growth proposals within the “Postgrowth” storyline.

For example, ~70% of flights in the UK are taken by 15% of the population, while at least half of the population take no flights at all in each year, three quarters of this air travel is by members of the middle and upper social classes (Harrabin, n.d.).

1.3.2.2. SCENARIOS

This entity includes a selection of simulated scenarios in the WILLIAM model with their description. Each scenario is based on one storyline, and a storyline can lead to more than one different scenarios.

1.3.2.3. SCENARIO POLICY MEASURES AND HYPOTHESES

Each simulated scenario includes some input parameters in the form of predefined policy measures and hypotheses. These parameters are Symbols already stored in the Data Dictionary, having their “Project Type of Value” property set as “Scenario Parameter”. These scenario policy measure and hypothesis entities are available in the database for each scenario.

The main entities included in the main output variables of WILLIAM part of the database include:

1.3.2.4. SCENARIO OUTPUTS – FUTURE PROJECTIONS

Each simulated scenario leads to some results. These results are Symbols already stored in the Data Dictionary, having their “Project Type of Value” property set as “Variable”. Each Scenario Output entity represents a model simulation obtained at a specific time. Each Future Projection Entity represents the result for Symbols of a specific simulation along with their indices (e.g., regions), if they are indexed.

1.3.2.5. FUTURE PROJECTIONS VALUES

Each scenario output is stored as a timeline series representing the future projection values for the output variables. The future projections of the main output variables are available as tables and plots.

1.3.3. FUNCTIONALITIES OF THE DATABASE OF SELECTED SIMULATED SCENARIOS AND RESULTS BY TYPE OF USER

1.3.3.1. NON-REGISTERED USERS

A non-registered user can access the menu of the WILLIAM Database of selected simulated scenarios and results through “View public data”. The overview of the Home page and its main entities is provided in Figure 78.



Figure 78. Home page of the WILIAM Database of selected simulated scenarios and results

Before accessing the features of the Storylines and Scenarios, the user can access the Section “Others” in order to obtain information on the main aspects related to the development of the features of the “Storylines” and “Scenarios” Sections.

1.3.3.1.1. OTHERS

The user can **view the “Others” Section** (Figure 79) through:

Menu/ Others

This Section allows the user to view the list of:

- Definitions
- Storyline Overall Goals
- Policy measures
- Hypotheses
- Manual

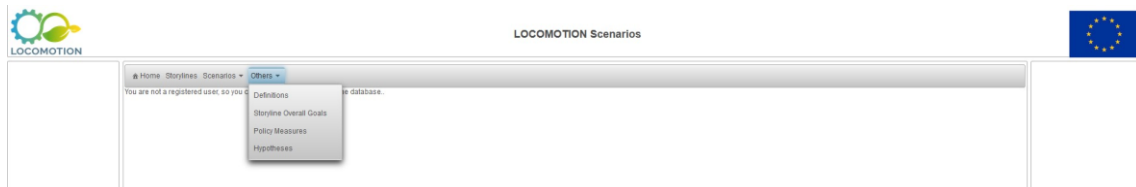


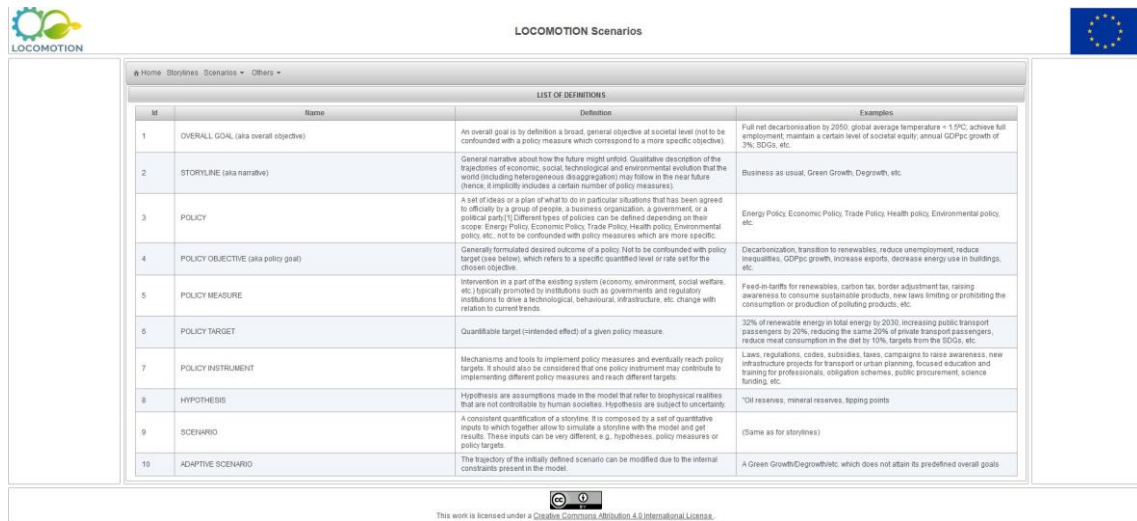
Figure 79. Others List main page

DEFINITIONS

The user can **access the Definitions list** (Figure 80) through:

Menu/ Others/ Definitions

In this page the user can view the list of common Definitions in LOCOMOTION with examples.



LOCOMOTION Scenarios			
LIST OF DEFINITIONS			
ID	Name	Definition	Examples
1	OVERALL GOAL (aka overall objective)	An overall goal to be defined a broad, general objective at societal level (not to be confounded with a policy measure which correspond to a more specific objective)	Full net decarbonisation by 2050, global average temperature + 1.5°C, achieve full employment, maintain a certain level of societal equity, annual GDPpc growth of 3%, SDGs, etc.
2	STORYLINE (aka narrative)	General narrative about how the future might unfold. Qualitative description of the trajectories of economic, social, technological and environmental evolution that the world (including heterogeneous disaggregation) may follow in the near future (hence, it implicitly excludes a certain number of policy measures)	Business as usual, Green Growth, Degrowth, etc.
3	POLICY	A set of ideas or a plan of what to do in particular situations that has been agreed to officially by a group of people, a business organization, a government, or a political party. (5 Different types of policies, can be defined depending on their scope: Energy Policy, Economic Policy, Trade Policy, Health policy, Environmental policy, etc., not to be confounded with policy measures which are more specific)	Energy Policy, Economic Policy, Trade Policy, Health policy, Environmental policy, etc.
4	POLICY OBJECTIVE (aka policy goal)	Generally formulated desired outcome of a policy. Not to be confounded with policy target (see below), which refers to a specific quantified level or rate set for the chosen objective	Decarbonization, transition to renewables, reduce unemployment, reduce inequalities, GDPpc growth, increase exports, decrease energy use in buildings, etc.
5	POLICY MEASURE	Intervention in a part of the existing system (economy, environment, social welfare, etc.) typically promoted by institutions such as governments and regulatory institutions to drive a technological, behavioural, infrastructure, etc. change with relation to current trends	Feed-in-tariffs for renewables, carbon tax, border adjustment tax, raising awareness to consume sustainable products, new laws limiting or prohibiting the consumption or production of polluting products, etc.
6	POLICY TARGET	Quantifiable target (intended effect) of a given policy measure	32% of renewable energy in total energy by 2030, increasing public transport passengers by 20%, reducing the same 20% of private long-haul passengers, reduce meat consumption in the diet by 10%, targets from the SDGs, etc.
7	POLICY INSTRUMENT	Mechanisms and tools to implement policy measures and eventually reach policy targets. It should also be considered that one policy instrument may contribute to implementing different policy measures and reach different targets	Laws, regulations, codes, subsidies, taxes, campaigns to raise awareness, new infrastructure projects for transport or urban planning, focused education and training for professionals, obligation schemes, public procurement, science funding, etc.
8	HYPOTHESIS	Hypothesis are assumptions made in the model that refer to biophysical realities that are not controllable by human societies. Hypothesis are subject to uncertainty	"Oil reserves, mineral reserves, tipping points
9	SCENARIO	A consistent quantification of a storyline. It is composed of a set of quantitative inputs to which together allow to simulate a storyline with the model and get results. These inputs can be very different, e.g., hypotheses, policy measures or policy targets	(Same as for storylines)
10	ADAPTIVE SCENARIO	The trajectory of the initially defined scenario can be modified due to the internal constraints present in the model	A Green Growth/Degrowth/etc. which does not attain its predefined overall goals

Figure 80. Definitions List main page

STORYLINE OVERALL GOALS

The user can access the Storyline Overall Goals list (Figure 81) through:

Menu/ Others/ Storyline Overall Goals

The user can view the existing Storyline Overall Goals. Each LOCOMOTION storyline has economic, environmental and socioeconomic goals. These storyline goals (drivers) are used to determine exogenous inputs to the model so as to ensure that the storyline is properly translated into a scenario.

The baseline storyline SSP2 has the economic goal of GDPpc growth, but lacks explicit environmental goals. With respect to the policy action storylines, while Green growth and Green deal have GDPpc growth as an economic goal, Post-growth is driven by the idea of economic re-localization. Environmental goals are prioritized in all storylines, albeit through different means. Finally, Green growth does not have a socioeconomic goal, while Green deal and Post-growth have specific inclusion policies and universal social policies as drivers respectively.

The list of WILIAM overall goals has been linked to storylines and storyline goals (drivers) specifically. For example, the overall goal to use land sustainably is linked to storyline goals (drivers) in all three policy action storylines. Whereas, the overall goal of universal access to education is only linked to storyline goals (drivers) in Green deal and Post-growth. Moreover, the overall goals of minimizing migration and gender equality are only linked to expanded overall goals and not to the storyline drivers.

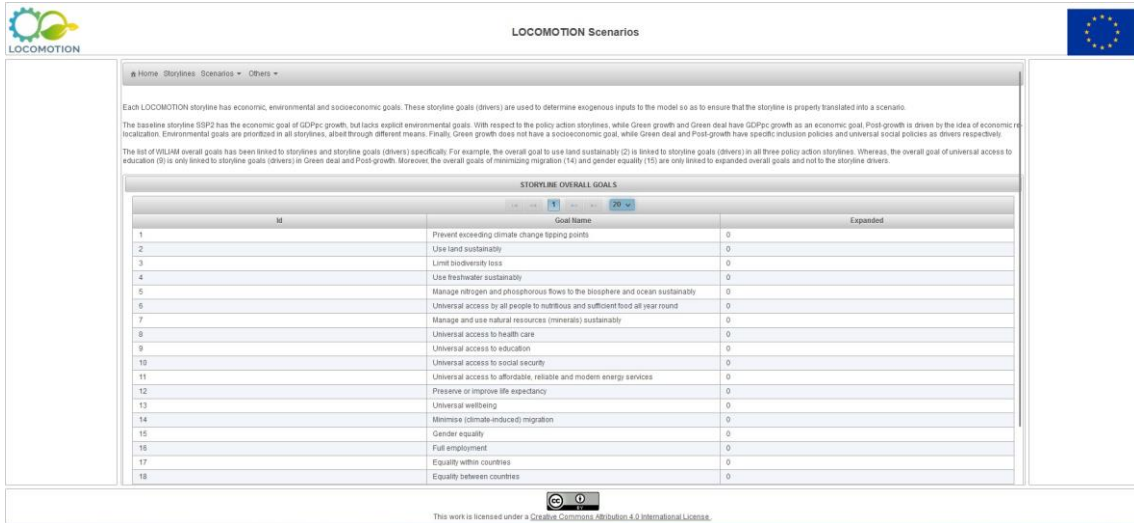


Figure 81. Storyline Overall Goals List main page

This list aims to include the complete list of Storyline Overall Goals that have been selected in WILIAM. The link between Storyline Overall Goals and each of the Storylines is then performed through:

Menu/ Storylines (for details see Section 1.3.3.1.2 Storylines).

POLICY MEASURES

The user can access the list of Policy Measures (Figure 82) through:

Menu/ Others/ Policy Measures

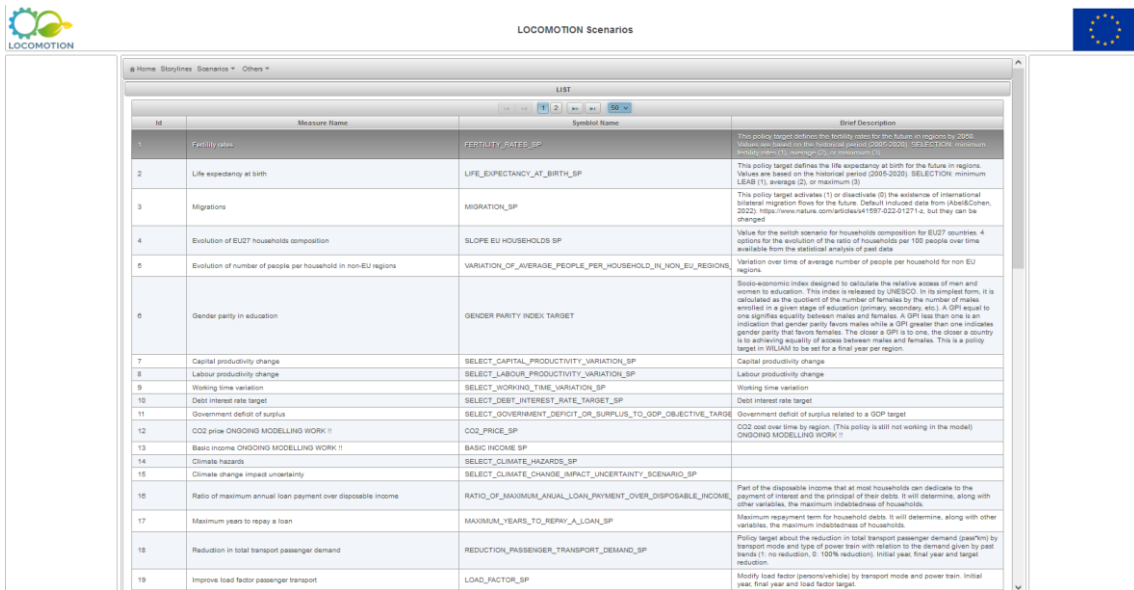


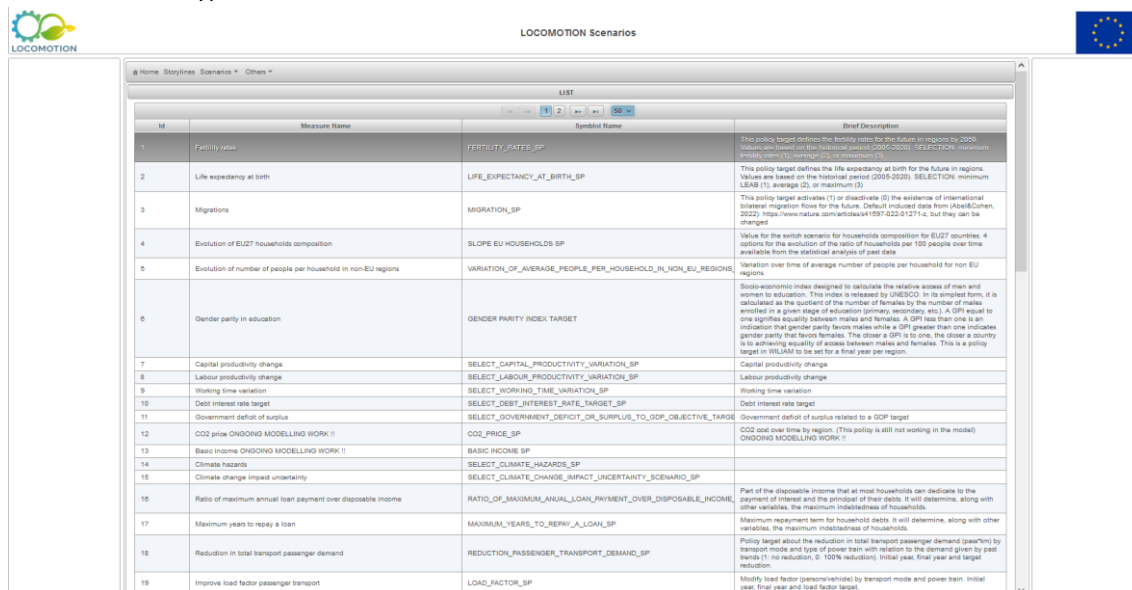
Figure 82. Policy Measures List main page

This page provides the user with an overview of the list of policy measures featured in WILLIAM, information on the Symbol associated with each policy measure and a brief narrative description of the policy measure.

HYPOTHESES

The user can **access the list of Hypotheses** (Figure 83) through:

Menu/ Others/ Hypotheses



ID	Measure Name	Symbol Name	Brief Description
1	Fertility rates	FERTILITY_RATES_SP	This policy target defines the fertility rates for 19 EU regions in 2040. Values are based on the historical period (2005-2020). SELECTION: minimum LEAS (1), average (2), or maximum (3).
2	Life expectancy at birth	LIFE_EXPECTANCY_AT_BIRTH_SP	This policy target defines the life expectancy at birth for the future in regions. Values are based on the historical period (2005-2020). SELECTION: minimum LEAS (1), average (2), or maximum (3).
3	Migrations	MIGRATION_SP	This policy target activates (1) or deactivates (0) the existence of international bilateral migration flows for the future. (Default) included data from (Abel/Cohen, 2022). Note: these values are not absolute (100'000'000'000'000'000), but they can be changed.
4	Evolution of EU27 households composition	SLOPE EU HOUSEHOLDS SP	Values for the switch scenario for households composition for EU27 countries: 4 options for the evolution of the ratio of households per 100 people over time available from the statistical analysis of past data.
5	Evolution of number of people per household in non-EU regions	VARIATION_OF_AVERAGE_PEOPLE_PER_HOUSEHOLD_IN_NON_EU_REGIONS	Variation over time of average number of people per household for non EU regions.
6	Gender parity in education	GENDER_PARITY_INDEX_TARGET	Socio-economic index designed to calculate the relative access of men and women to education. This index is released by UNESCO. In its simplest form, it is calculated as the quotient of the number of females by the number of males enrolled in a given stage of education (primary, secondary, etc.). A GPI equal to one signifies equality between males and females. A GPI less than one is an indication that gender parity favors males while a GPI greater than one indicates gender parity that favors females. The closer a GPI is to one, the closer a country is to achieving equality of access between males and females. This is a policy target in WILLIAM to be set for a final year per region.
7	Capital productivity change	SELECT_CAPITAL_PRODUCTIVITY_VARIATION_SP	Capital productivity change
8	Labour productivity change	SELECT_LABOUR_PRODUCTIVITY_VARIATION_SP	Labour productivity change
9	Working time variation	SELECT_WORKING_TIME_VARIATION_SP	Working time variation
10	Debt interest rate target	SELECT_DEBT_INTEREST_RATE_TARGET_SP	Debt interest rate target
11	Government deficit of surplus	SELECT_GOVERNMENT_DEFCIT_OR_SURPLUS_TO_GDP_OBJECTIVE_TARGET	Government deficit of surplus related to a GDP target
12	CO2 price ONGOING MODELLING WORK !!	CO2_PRICE_SP	CO2 cost over time by region. (This policy is still not working in the model) ONGOING MODELLING WORK !!
13	Basic income ONGOING MODELLING WORK !!	BASIC_INCOME_SP	
14	Climate hazards	SELECT_CLIMATE_HAZARDS_SP	
15	Climate change impact uncertainty	SELECT_CLIMATE_CHANGE_IMPACT_UNCERTAINTY_SCENARIO_SP	
16	Ratio of maximum annual loan payment over disposable income	RATIO_OF_MAXIMUM_ANNUAL_LOAN_PAYMENT_OVER_DISPOSABLE_INCOME	Part of the disposable income that at most households can dedicate to the payment of interest and the principal of their debts. It will determine, along with other variables, the maximum indebtedness of households.
17	Maximum years to repay a loan	MAXIMAL_YEARS_TO_REPAY_A_LOAN_SP	Maximum repayment term for household debts. It will determine, along with other variables, the maximum indebtedness of households.
18	Reduction in total transport passenger demand	REDUCTION_PASSENGER_TRANSPORT_DEMAND_SP	Policy target about the reduction in total transport passenger demand (pass/km) by transport mode and type of power train with relation to the demand given by past series (1: no reduction, 0: 100% reduction). Initial year, final year and target reduction.
19	Improve load factor passenger transport	LOAD_FACTOR_SP	Modify load factor (persons/vehicle) by transport mode and power train. Initial year, final year and load factor target.

Figure 83. Hypotheses List main page

This page provides the user with an overview of the list of hypotheses featured in WILLIAM, information on the Symbol associated with each hypothesis and a brief narrative description of the hypothesis.

MANUAL

The user can **download the Manual of the database** through:

Menu/ Others/ Manual

1.3.3.1.2. STORYLINES

View existing Storylines

The user can **view existing Storylines** (Figure 84) through:

Menu/ Storylines

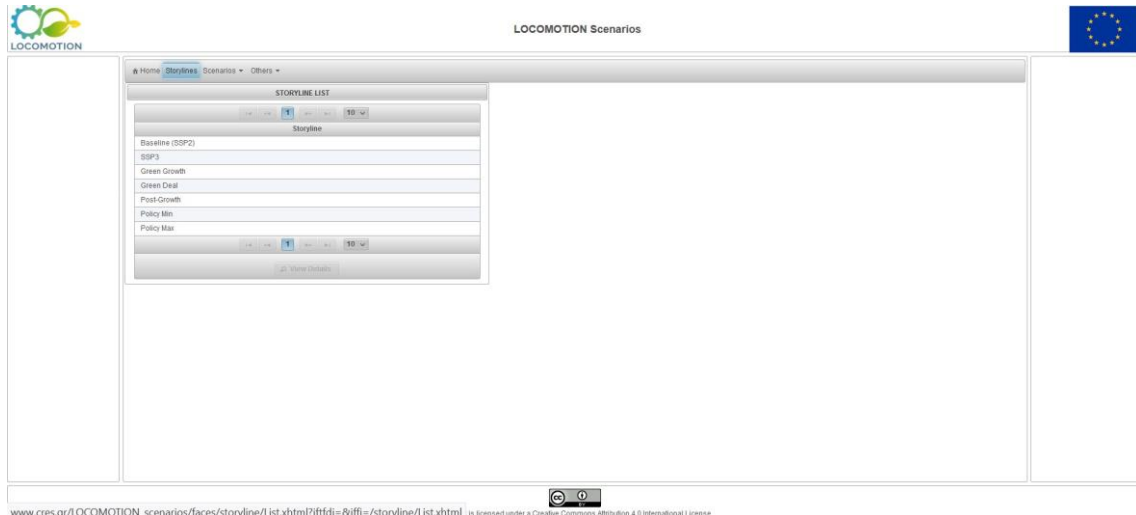


Figure 84. Storylines List main page

The user can **view all the details of a Storyline** through:

Menu/ Storyline: Select an Storyline in list and press "View details"

Storyline Fields

The user can **view the fields of a Storyline**, as it can be seen in Figure 85.

This includes the name of the storyline, as well as a narrative description of the storyline.

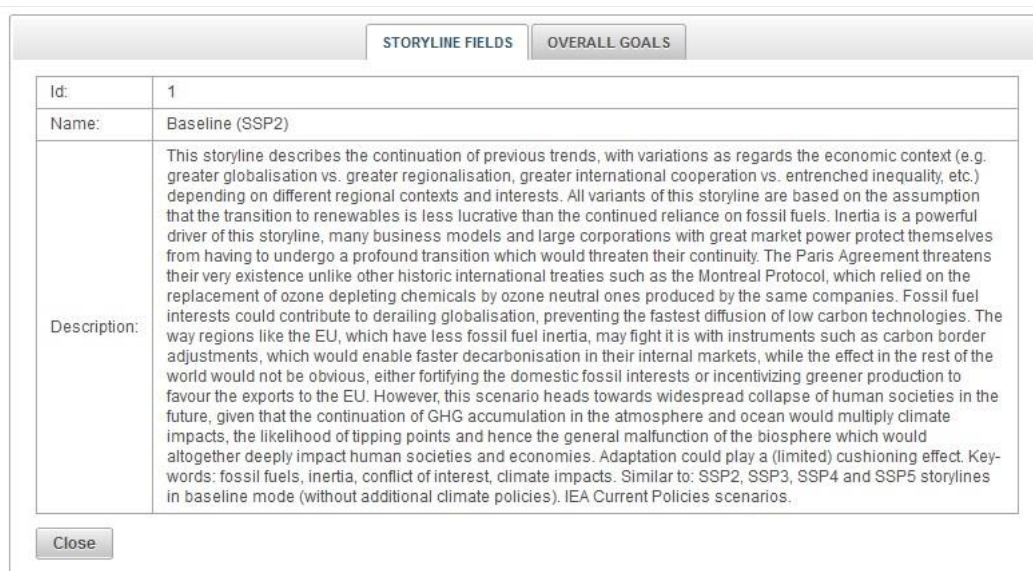


Figure 85. Storyline Fields page

Storyline Overall Goals

The user can **view the overall goals linked to a Storyline**, as it can be seen in Figure 86.

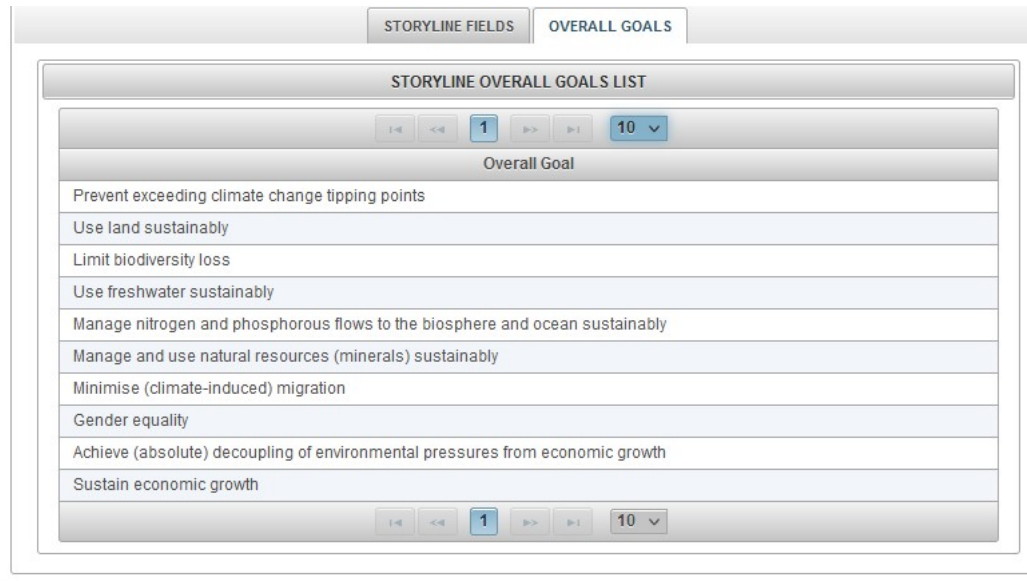


Figure 86. Storyline Overall Goals page

1.3.3.1.3. SCENARIOS

SCENARIOS PARAMETERS

The user can **view the Scenarios and the Scenario input parameters** (Figure 87) through:

Menu/ Scenarios/ Parameters



Figure 87. Scenarios List main page

In this page the user can view the list of scenarios.

The user can **view the details of a Scenario** (Figure 88) through:

Menu/ Scenarios/ Parameters: Select a Scenario and in the bottom of the page press “View”

In this window, the user has several options, which are presented below.

Scenario fields

The user can **view the Scenario fields**, i.e., Scenario Name, the narrative Description of the Scenario and the Storyline that is associated with the Scenario.

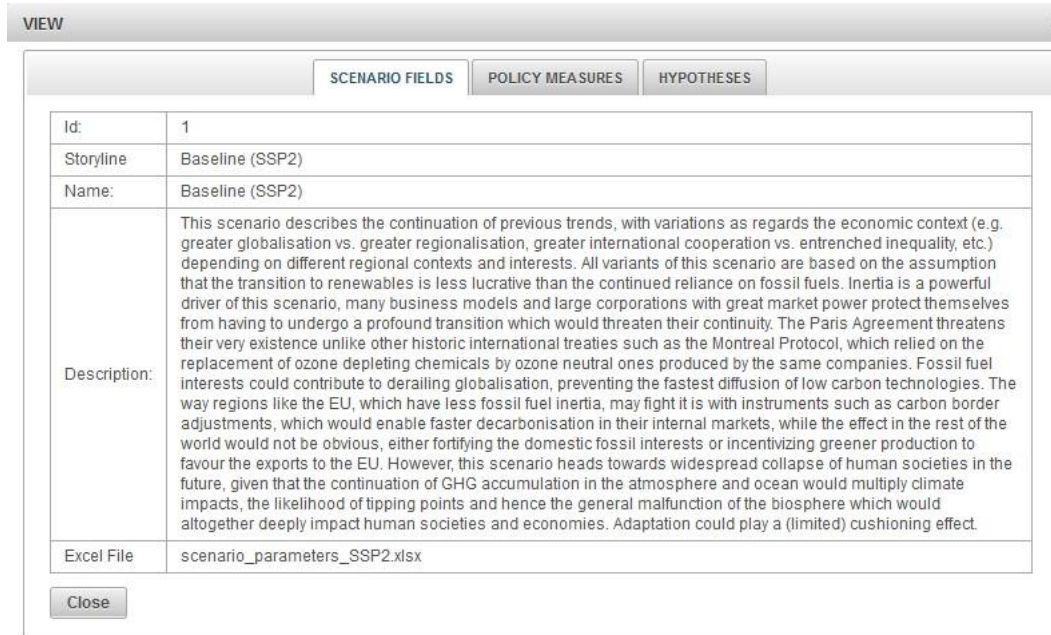


Figure 88. View Scenario page

Policy measures

The user can **view the list of Policy measures** and the Scenario input values for each policy measure (Figure 89).

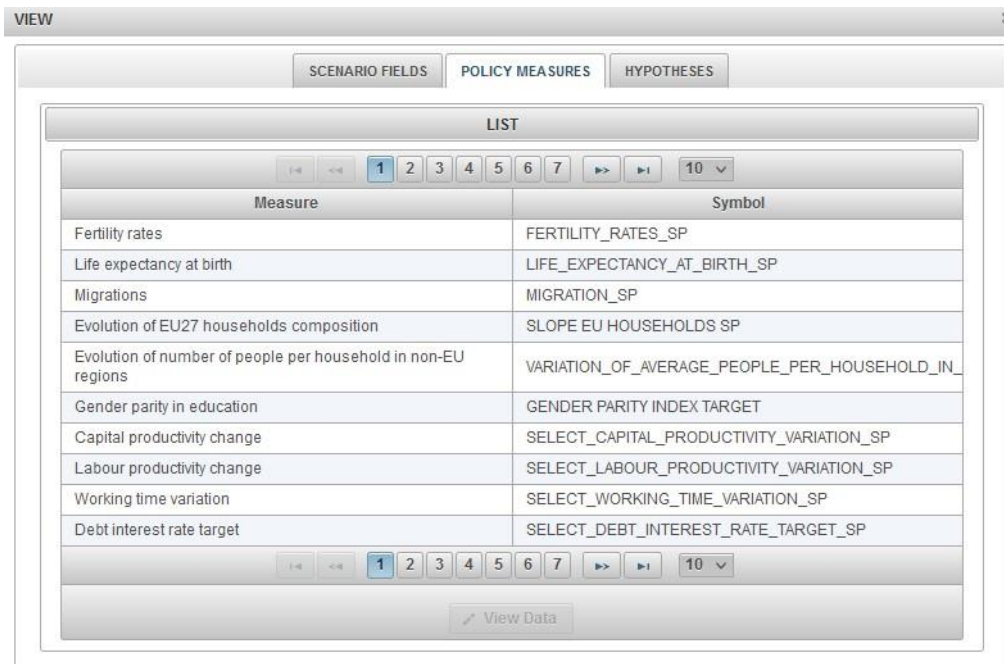


Figure 89. View Policy Measures associated with a Scenario page

The user can **view the input parameters of a Scenario** (Figure 90) through the Policy Measures page: Select a Policy Measure and in the bottom of the page press “View Data”.

POLICY SCENARIO PARAMETERS	TARGET_YEAR_FERTILITY_RATES_SP	OBJECTIVE_FERTILITY_RATES_SP
REGIONS_I _UNIT	YEAR	DMNL
AUT	2050.0	2.0
BEL	2050.0	2.0
BGR	2050.0	2.0
HRV	2050.0	2.0
CYP	2050.0	2.0
CZE	2050.0	2.0
DNK	2050.0	2.0
EST	2050.0	2.0
FIN	2050.0	2.0
FRA	2050.0	2.0
DEU	2050.0	2.0
GRC	2050.0	2.0
HUN	2050.0	2.0
IRL	2050.0	2.0
ITA	2050.0	2.0
LVA	2050.0	2.0
LTU	2050.0	2.0
LUX	2050.0	2.0
MLT	2050.0	2.0
NLD	2050.0	2.0
POL	2050.0	2.0
PRT	2050.0	2.0

Figure 90. Example of Policy Measure inputs for a Scenario view

Scenario Hypotheses

The user can **view the list of Scenario Hypotheses** and the Scenario Hypotheses input values for each hypothesis (Figure 91).

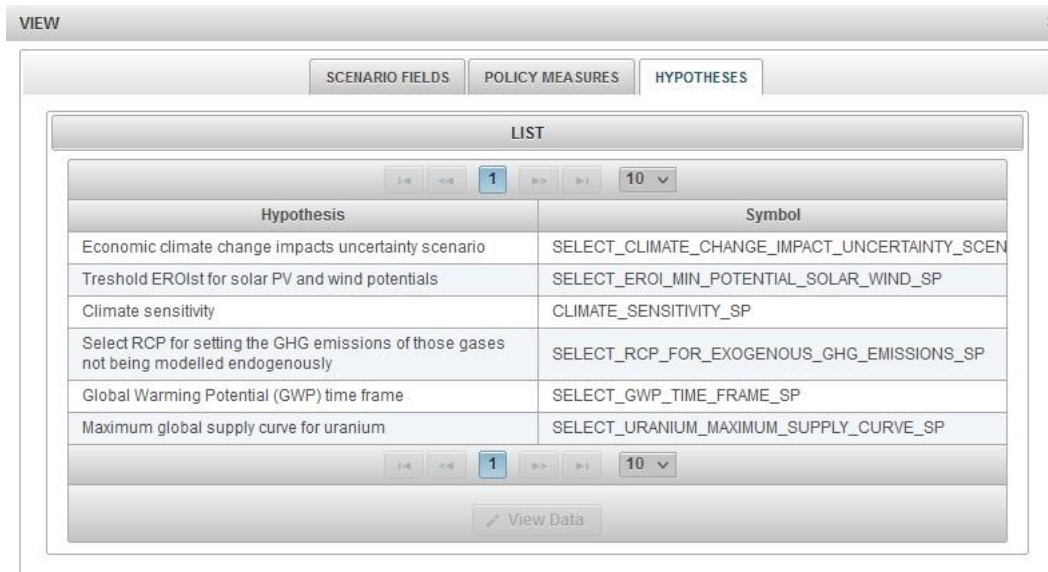


Figure 91. View Scenario Hypotheses page

The user can **view the input parameters of a Scenario Hypothesis** (Figure 92) through the Hypotheses page: Select a Hypothesis and in the bottom of the page press “View Data”.



Figure 92. Example of Hypotheses inputs for a Scenario view

RESULTS

The user can **view the Scenario Results** (Figure 93) through:

Menu/ Scenarios/ Results

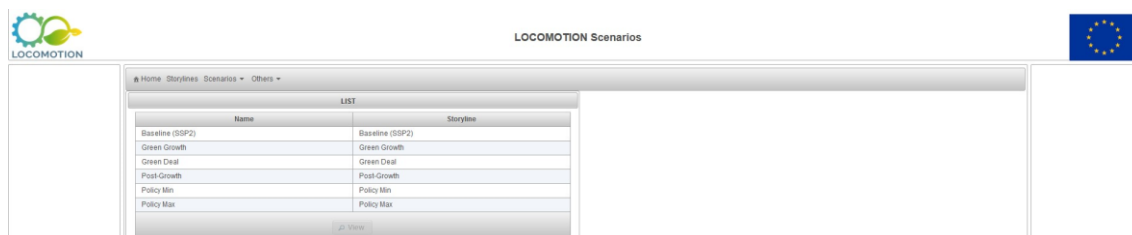


Figure 93. Scenarios Results main page

In this page the user can view the list of scenarios.

The user can **view the Results of a Scenario** through:

Menu/ Scenarios/ Results: Select a Scenario and in the bottom of the page press “View”

A new table appears with the available model simulations, the date when they were obtained and information on the model version (Figure 94).

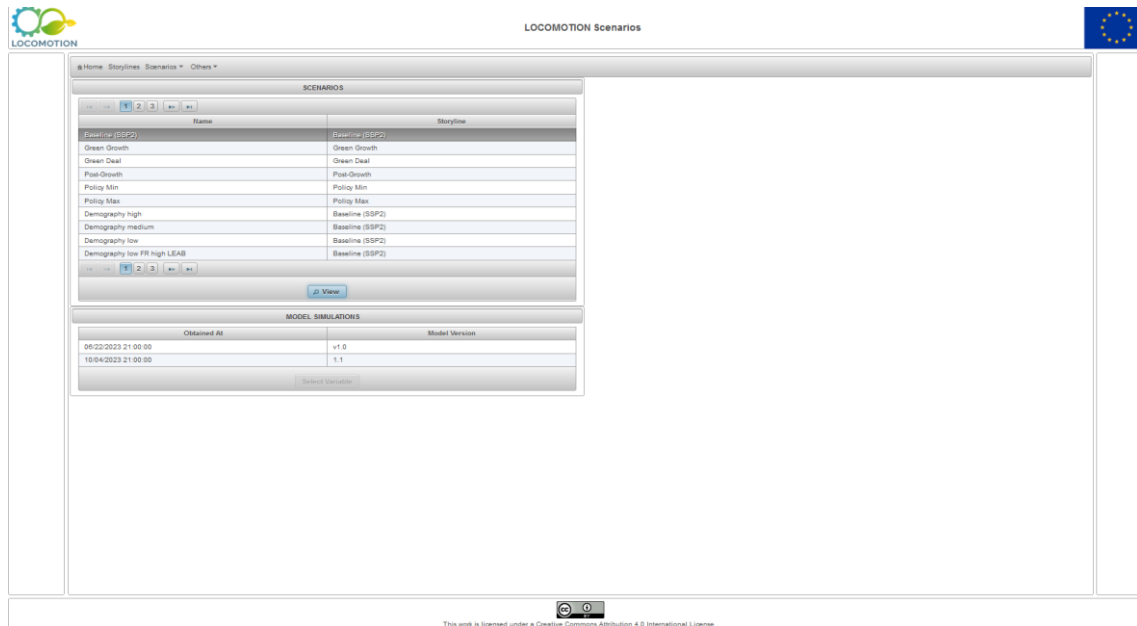


Figure 94. Scenarios Results selection page

The user can select the model simulation available and press “Select Variable”. A new window appears, as it can be seen in Figure 95. In this window the user has the option to use search criteria to filter a Variable. These criteria include the Variable name and the main module of the Variable. The search can be flexible or not, i.e., the Variable name must match exactly or partially the search text. Otherwise, the complete list of Variables appears.

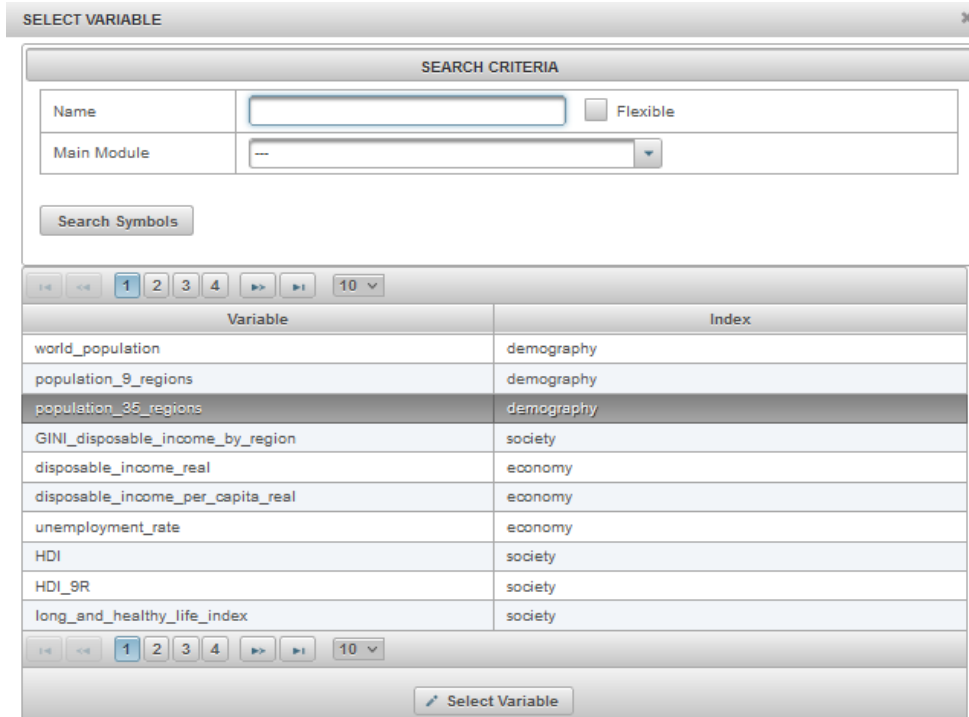


Figure 95. Results Variable selection page

The user can select a Variable out of the list and press “Select Variable”.

A new table appears which provides information on the Variable name, Unit and associated Module (Figure 96). The user can press “View Data”.

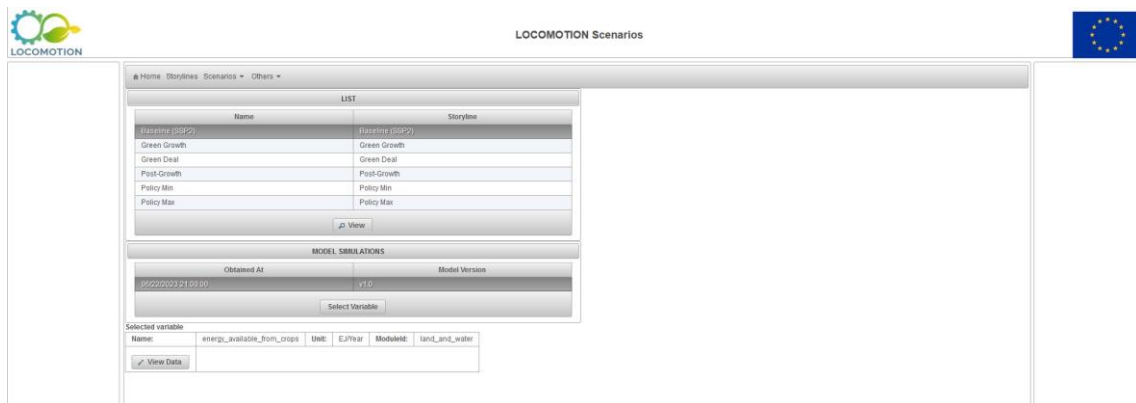


Figure 96. Results Variable page

The user can view the data associated with the selected Variable as a time series Table (Figure 97), which includes information on the module associated with the Variable, the unit of measurement, the indices associated with the Variable and the values of the Variable up to 2050. The user can scroll left to right using the bar at the bottom of the table to view the complete set of values.

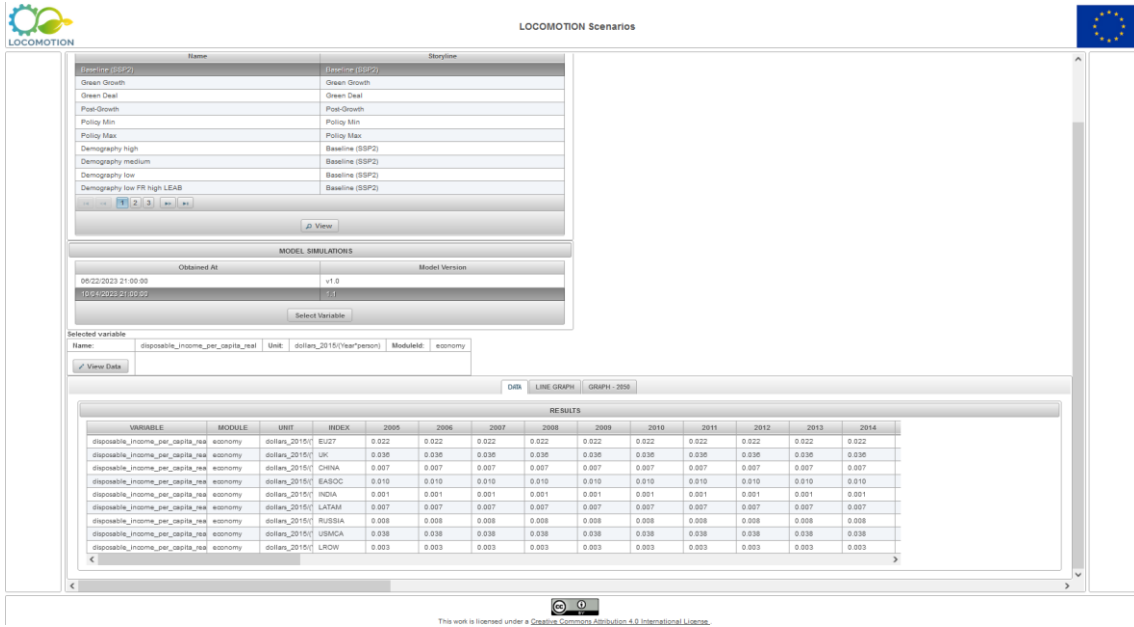


Figure 97. Results Table

The user can also view the data associated with the selected Variable as a Line Graph (Figure 98) or as a Bar Graph with data for 2050 (Figure 99).

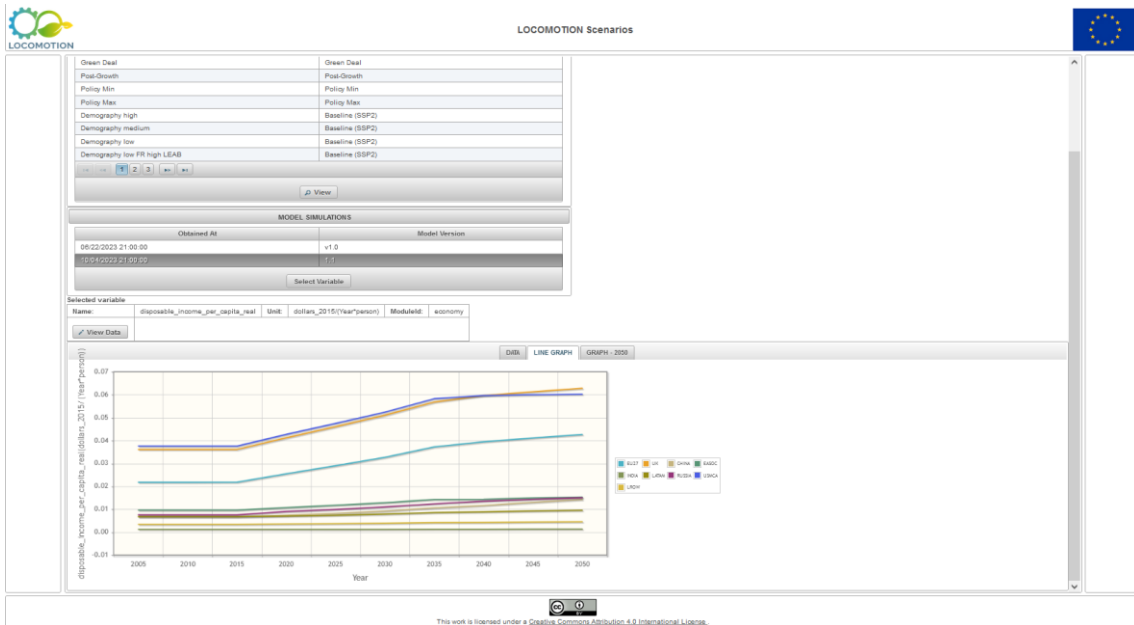


Figure 98. Results Line Graph

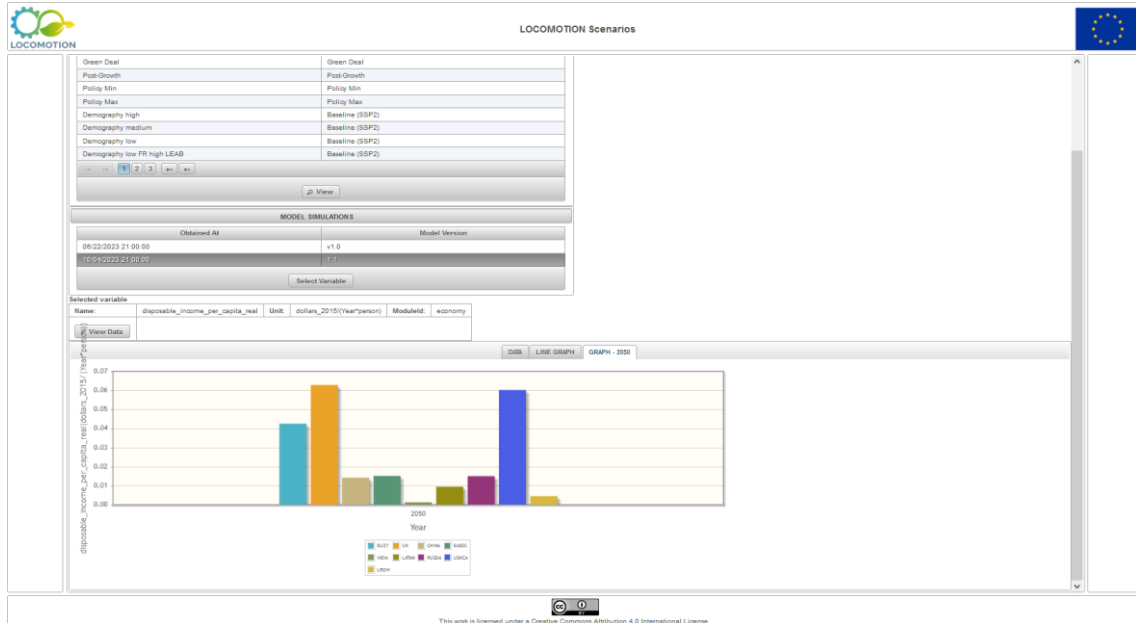


Figure 99. Bar Results Graph 2050

In order to have a clearer view of the graph results, the user has the option to unselect the presented features in the legend of the graph by clicking on them (Figure 100). This option allows the user to focus on selected results.

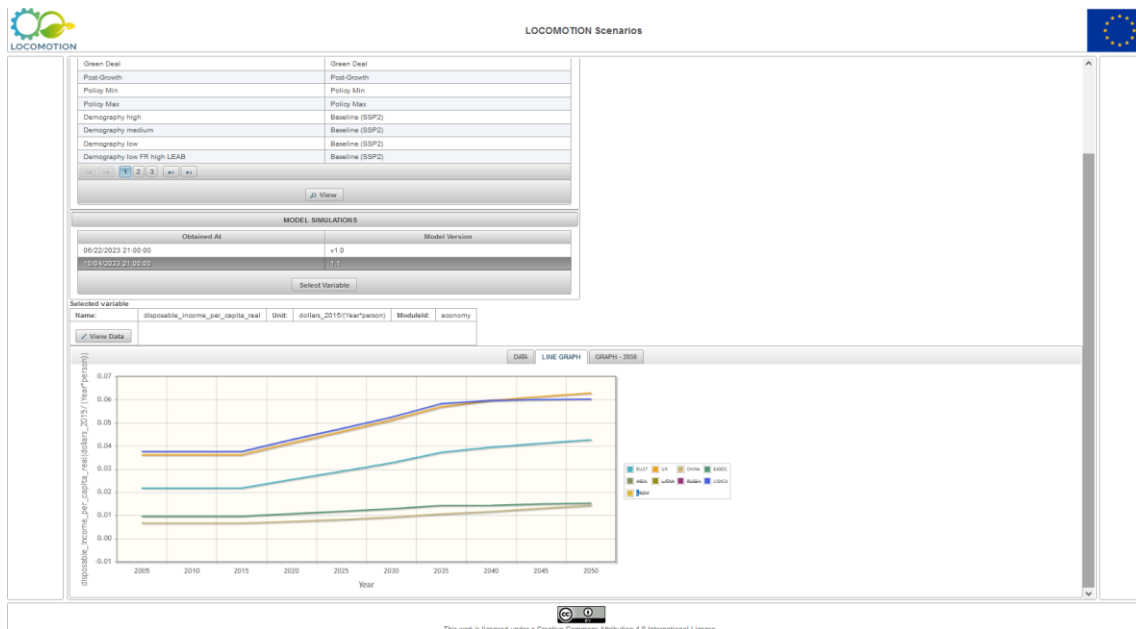


Figure 100. Results Line Graph selected by user

COMBINE SCENARIOS

The user can **combine Scenario Results** (Figure 101) through:

Menu/ Scenarios/ Combine Scenarios

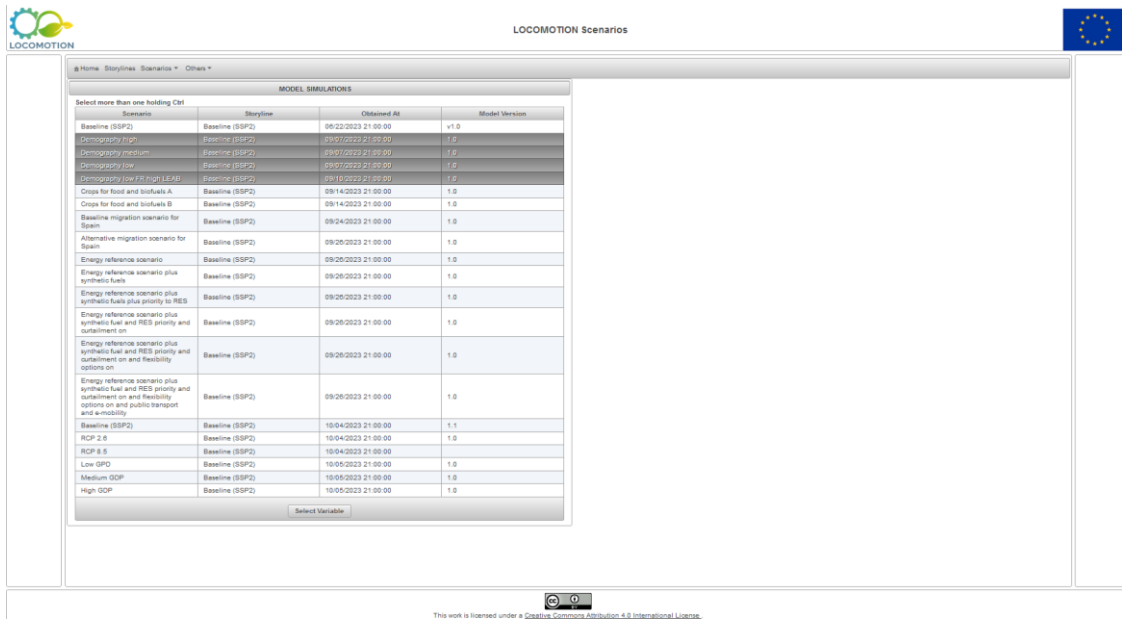


Figure 101. Combine Scenarios main page

In this page the user can view the list of scenarios, the date of the obtained results and the version of WILLIAM that was used to obtain these results. In addition, the user can select one or more Scenarios holding the Ctrl button while clicking on the preferred Scenarios. In order to obtain comparable results, it is advised to make a selection of comparable Scenarios, for example:

- 1) Demography high
- 2) Demography medium
- 3) Demography low
- 4) Demography low FR high LEAB

Or

- 1) Crops for food and biofuels A
- 2) Crops for food and biofuels B

Or

- 1) Baseline migration scenario for Spain
- 2) Alternative migration scenario for Spain

Or

- 1) Energy reference scenario
- 2) Energy reference scenario plus synthetic fuels
- 3) Energy reference scenario plus synthetic fuels plus priority to RES
- 4) Energy reference scenario plus synthetic fuels and RES priority and curtailment on
- 5) Energy reference scenario plus synthetic fuels and RES priority and curtailment on and flexibility options on
- 6) Energy reference scenario plus synthetic fuels and RES priority and curtailment on and flexibility options on and public transport and e-mobility

Or

- 1) RCP 2.6
- 2) RCP 8.5

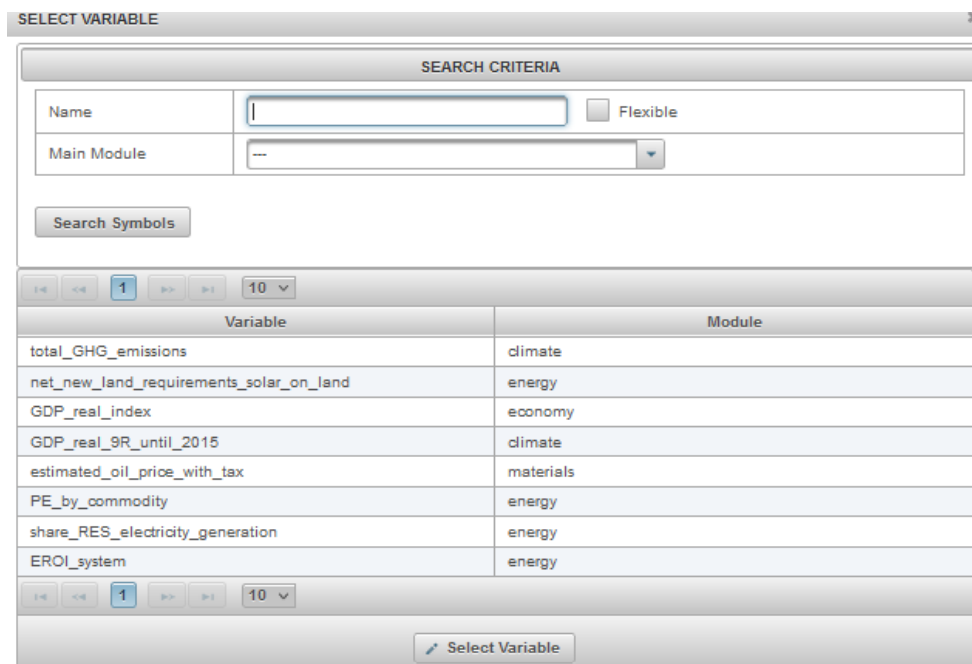
Or

- 1) Low GDP
- 2) Medium GDP
- 3) High GDP

The user can **select Scenarios and then view the Variables associated with the Scenarios** through:

Menu/ Scenarios/ Combine Scenarios: Select Scenarios and in the bottom of the page press “Select Variable”

A new window appears with the list of available Variables for the selected Scenarios (Figure 102). In this window the user has the option to use search criteria to filter a Variable. These criteria include the Variable name and the main module of the Variable. The search can be flexible or not, i.e., the Variable name must match exactly or partially the search text. Otherwise, the complete list of Variables appears.



The screenshot shows a window titled "SELECT VARIABLE" with a search criteria section and a table of variables.

SEARCH CRITERIA

Name: Flexible

Main Module:

Variable	Module
total_GHG_emissions	climate
net_new_land_requirements_solar_on_land	energy
GDP_real_index	economy
GDP_real_9R_until_2015	climate
estimated_oil_price_with_tax	materials
PE_by_commodity	energy
share_RES_electricity_generation	energy
EROI_system	energy

Figure 102. Combine Scenarios Variable selection page

The user can select a Variable out of the list and press “Select Variable”.

A new table appears which provides information on the Variable name, Unit and associated Module (Figure 103). The user can press “View Data” or in case the Variable is indexed “Select Index”.

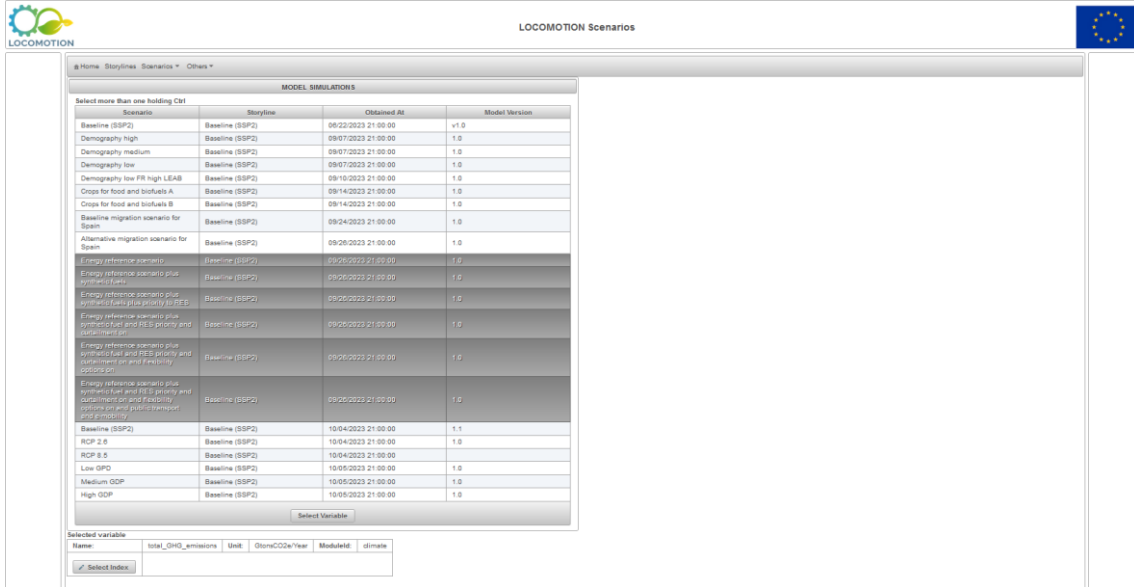


Figure 103. Combine Scenarios Variable page

In case the Variable is indexed, a new window appears with the list of available Indices for the selected Variable (Figure 104). In this window the user has the option to select one or more Indices by holding the Ctrl button and clicking “Select Index”.

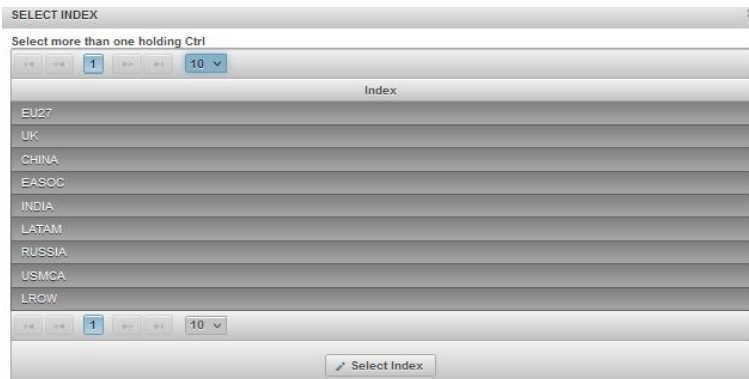


Figure 104. Combine Scenarios Select Index page

A new table becomes available in the main page with the list of selected Indices. The user can press the “View data” button below the table to view the results associated with these Indices (Figure 105).

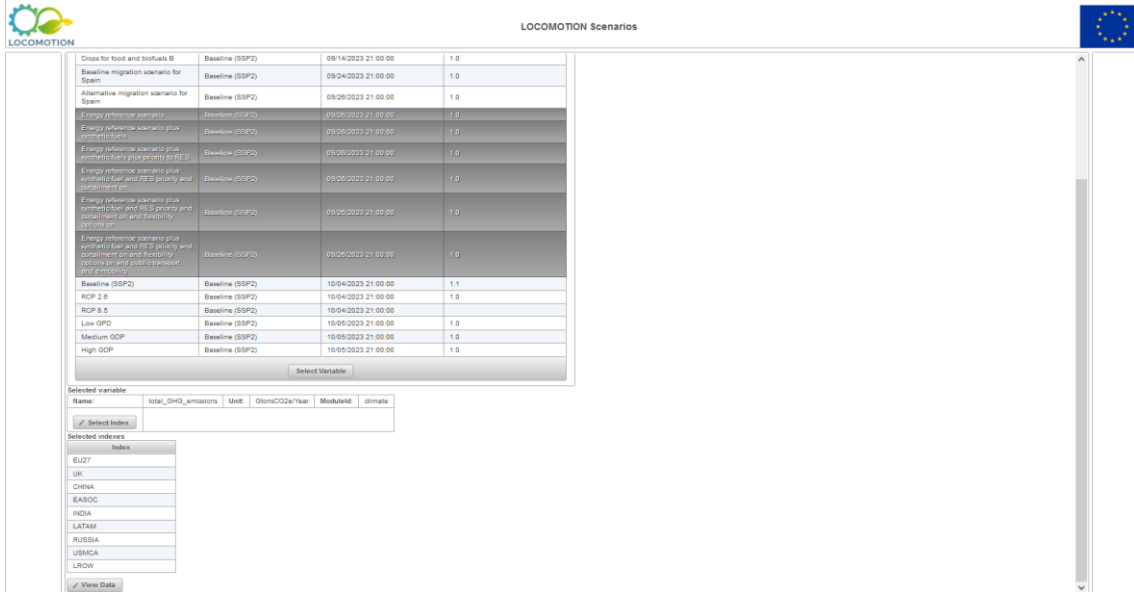


Figure 105. Combine Scenarios View Data page

The user can view the data associated with the selected Scenarios and Variable as a time series Table (Figure 106), which includes information on the module associated with the Variable, the unit of measurement and the indices associated with the Variable, the Scenarios and the values up to 2050. The user can scroll left to right using the bar at the bottom of the table to view the complete set of values.

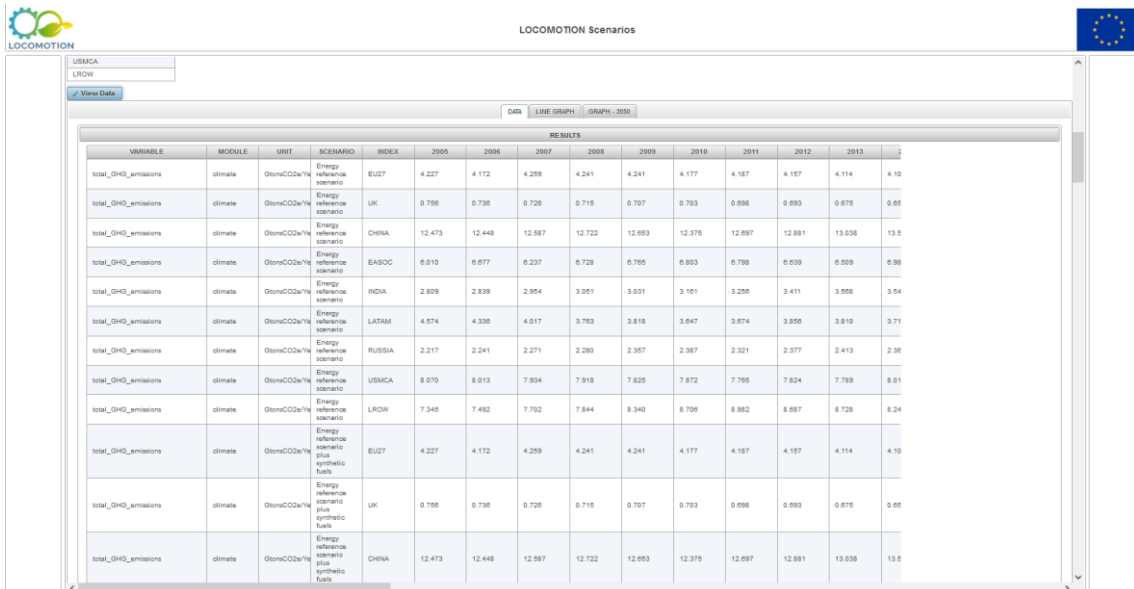


Figure 106. Combine Scenarios Results Table

The user can also view the data associated with the selected Scenarios and Variable as a Line Graph (Figure 107) or as a Bar Graph with data for 2050 (Figure 108).

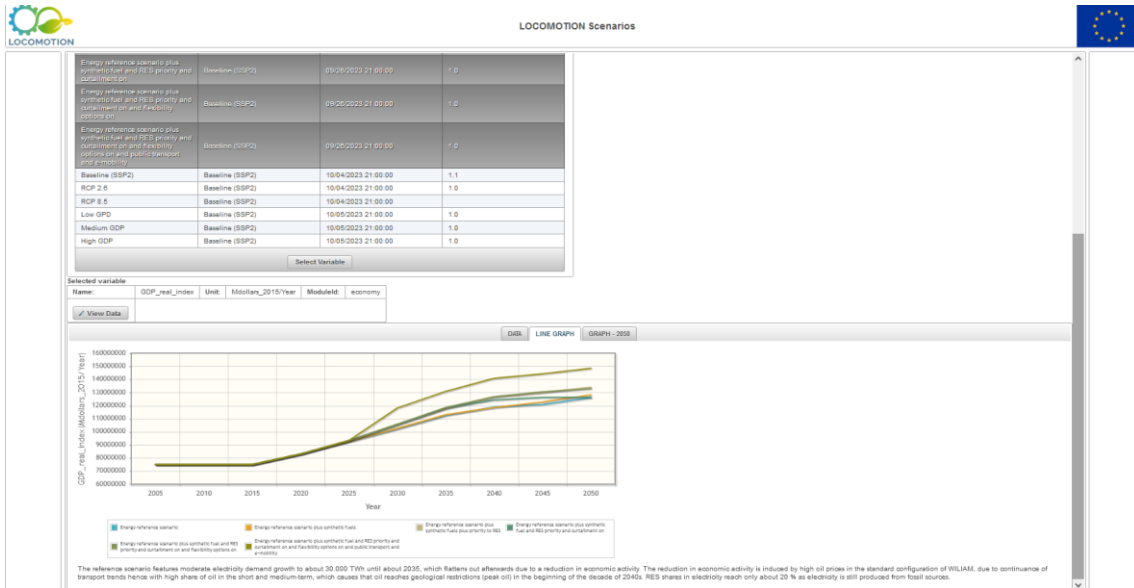


Figure 107. Combine Scenarios Results Line Graph

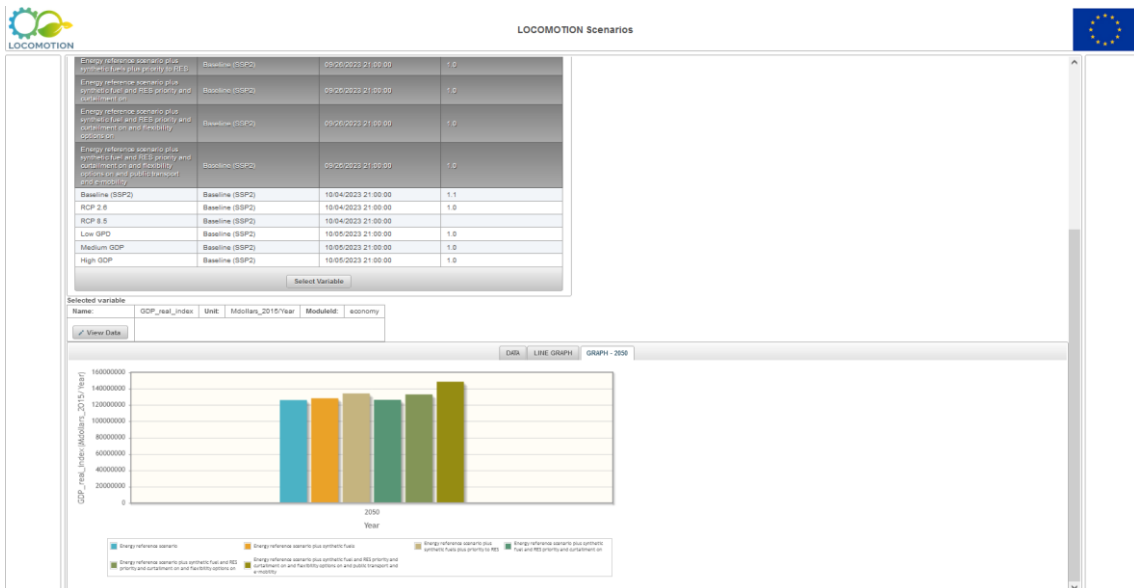


Figure 108. Combine Scenarios Bar Results Graph 2050

In order to have a clearer view of the graph results, the user has the option to unselect the presented features in the legend of the graph by clicking on them. This option allows the user to focus on selected results.

COMBINE VARIABLES

The user can **combine Scenario Variables** (Figure 109) through:

Menu/ Scenarios/ Combine Variables

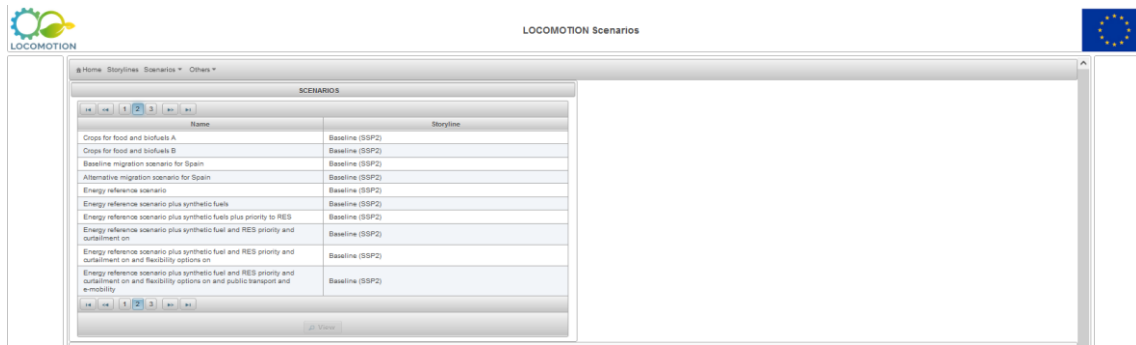


Figure 109. Combine Variables main page

In this page the user can view the list of scenarios.

The user can **view the Variables of a Scenario** through:

Menu/ Scenarios/ Combine Variables: Select a Scenario and in the bottom of the page press “View”

A new table appears with the available model simulations, the date when they were obtained and information on the model version (Figure 110).

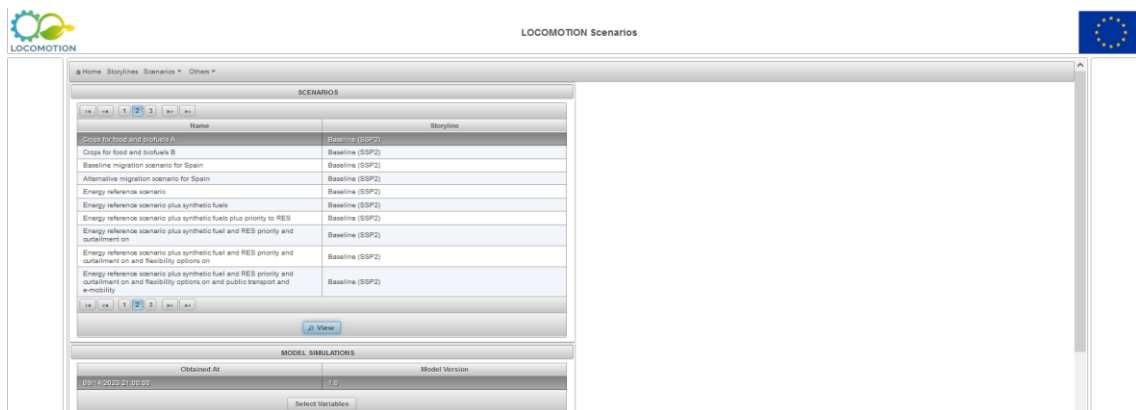


Figure 110. Combine Variables Results selection page

The user can select the model simulation available and press “Select Variables”. A new window appears, as it can be seen in Figure 111. In this window the user has the option to use search criteria to filter a Variable or Variables. These criteria include the Variable name and the main module of the Variable. The search can be flexible or not, i.e., the Variable name must match exactly or partially the search text. Otherwise, the complete list of Variables appears.

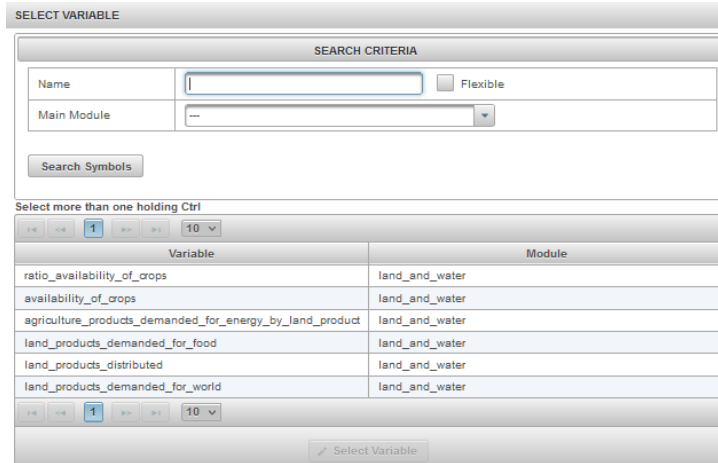


Figure 111. Combine Variables Search Variable main page

This feature is useful under specific conditions in order to allow users to compare Variables under the same scenario. For instance, in the Scenario “Crops for food and biofuels A” the user can select the Variables:

- 1) land_products_distributed
- 2) land_products_demanded_for_world

A new table appears which provides information on the Variable name, Unit and associated Module (Figure 112). The user can press “View Data”.

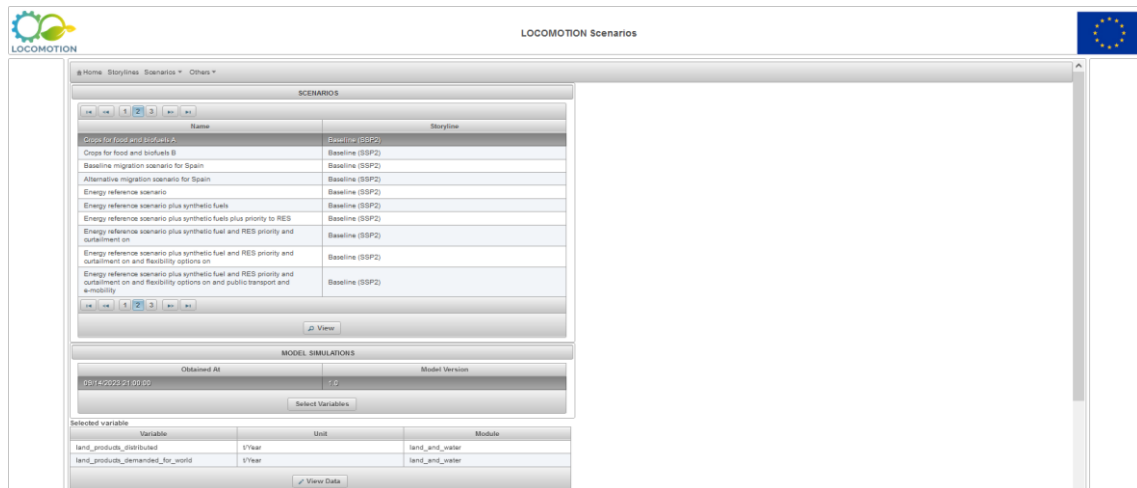


Figure 112. Combine Variables page

The user can view the data associated with the selected Scenario and Variables as a time series Table (Figure 113), which includes information on the module associated with the Variable, the unit of measurement, the indices associated with the Variables and the values up to 2050. The user can scroll left to right using the bar at the bottom of the table to view the complete set of values.

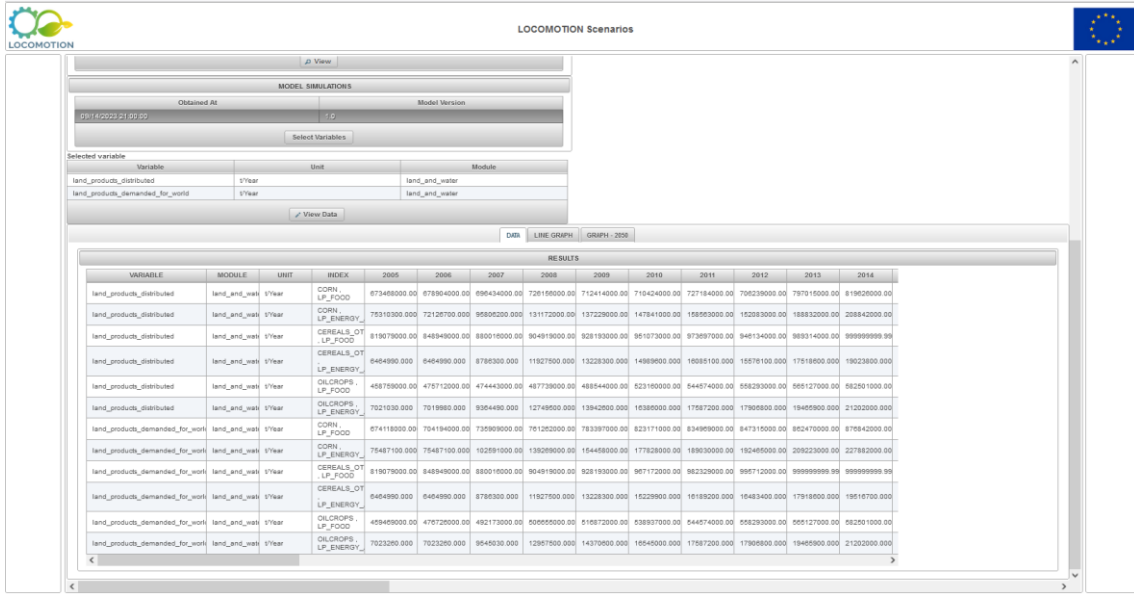


Figure 113. Combine Variables Results Table

The user can also view the data associated with the selected Variables as a Line Graph (Figure 114) or as a Bar Graph with data for 2050 (Figure 115).

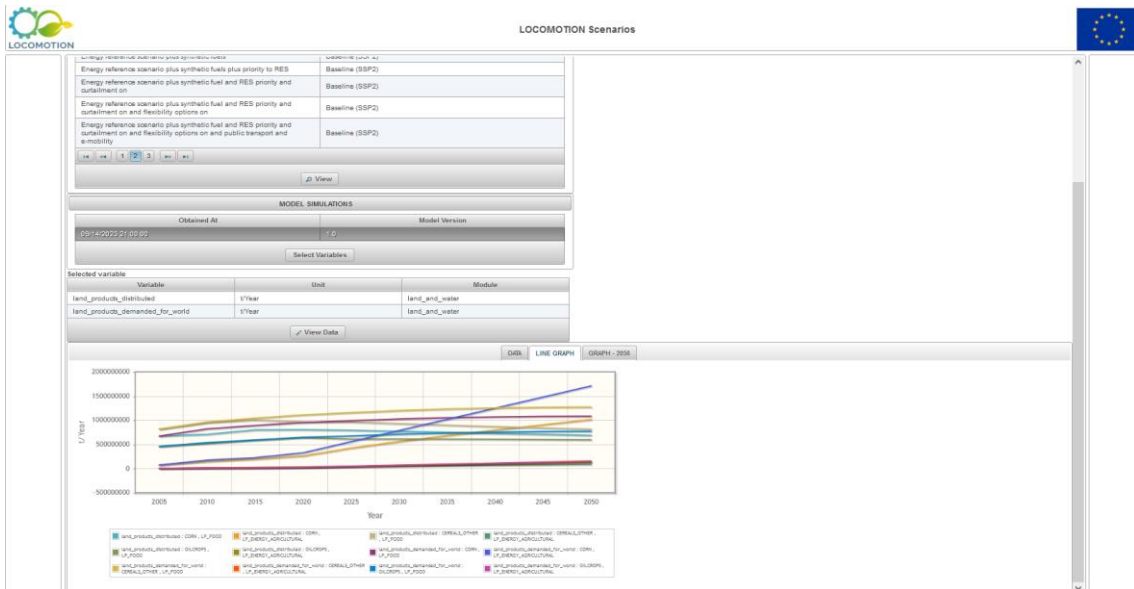


Figure 114. Combine Variables Results Line Graph

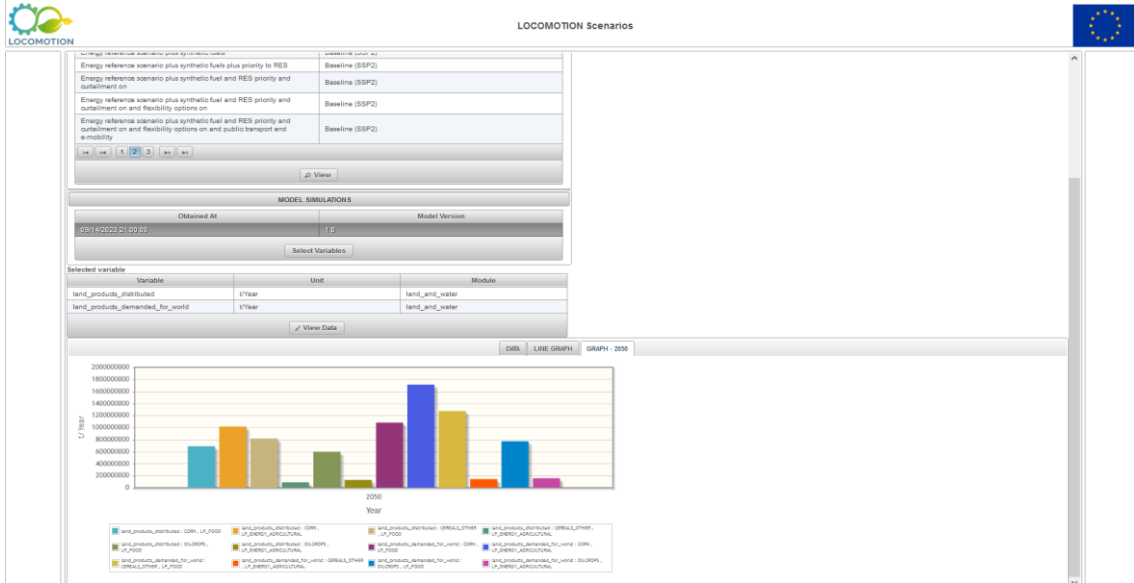


Figure 115. Combine Variables Bar Results Graph 2050

In order to have a clearer view of the graph results, the user has the option to unselect the presented features in the legend of the graph by clicking on them. This option allows the user to focus on selected results. For instance, Figure 116 shows the demand and distribution of corn for food and energy.

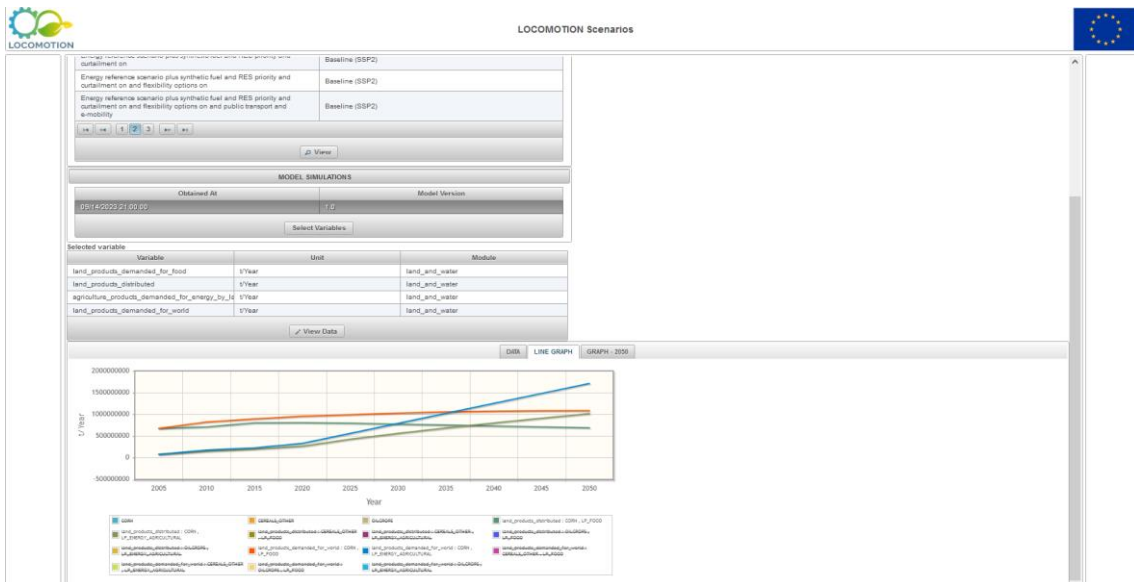


Figure 116. Combine Variables Results Line Graph selected results

1.3.3.2. REGISTERED USERS

A registered user can access and view the features and functionalities of the WILLIAM Database of selected simulated scenarios and results, similarly to non-registered users, and in addition they can create, edit or delete.

1.3.3.2.1. OTHERS

STORYLINE OVERALL GOALS

In addition to viewing **Storyline Overall Goals** through:

Menu/ Others/ Storyline Overall Goals

A registered user can also create new Storyline Overall Goals, edit or delete existing Storyline Overall Goals.

Create a new Storyline Overall Goal

The user can **introduce a new Storyline Overall Goal** through:

Menu/ Others/ Storyline Overall Goals, and in the bottom of the page press "Create". The user can add the new Storyline Overall Goal in the window that opens (Figure 117).



The screenshot shows a dialog box titled "CREATE NEW OVERALL GOAL" with a close button (X) in the top right corner. It contains two input fields: "Goal Name: *" and "Expanded:". Below the input fields are two buttons: "Save" and "Cancel".

Figure 117. Create the Overall Goals of a Storyline

Edit a Storyline Overall Goal

The user can **edit the Storyline Overall Goals**, as it can be seen in Figure 118 through:

In the "Storyline Overall Goals" window, select a Storyline Overall Goal and in the bottom of the page press "Edit".



The screenshot shows a dialog box titled "EDIT OVERALL GOAL" with a close button (X) in the top right corner. It contains three input fields: "Id:" with the value "1", "Goal Name: *" with the value "Prevent exceeding climate c", and "Expanded:" with the value "0". Below the input fields are two buttons: "Save" and "Cancel".

Figure 118. Edit the Overall Goals of a Storyline

Delete a Storyline Overall Goal

The user can **delete the Overall Goals of a Storyline** through:

In the “Storyline Overall Goals” window, select a Storyline Overall Goal and in the bottom of the page press “Delete”.

POLICY MEASURES

In addition to viewing **the list of Policy Measures** through:

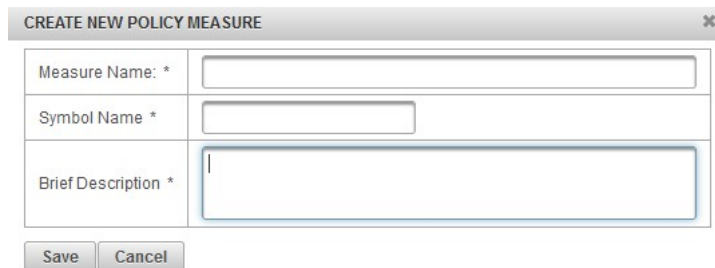
Menu/ Others/ Policy Measures

A registered user can also create new Policy Measures, edit or delete existing Policy Measures.

Create a new Policy Measure

The user can **introduce a new Policy Measure** through:

Menu/ Others/ Policy Measures, and in the bottom of the page press “Create”. The user can add the new Policy Measure in the window that opens (Figure 119Figure 117).



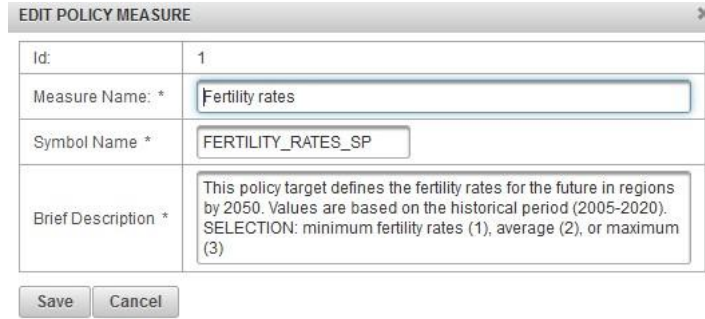
CREATE NEW POLICY MEASURE	
Measure Name *	<input type="text"/>
Symbol Name *	<input type="text"/>
Brief Description *	<input type="text"/>
<input type="button" value="Save"/> <input type="button" value="Cancel"/>	

Figure 119. Create a Policy Measure

Edit a Policy Measure

The user can **edit a Policy Measure**, as it can be seen in Figure 120 through:

In the “Policy Measures” window, select a Policy Measure and in the bottom of the page press “Edit”.



Id:	1
Measure Name: *	Fertility rates
Symbol Name *	FERTILITY_RATES_SP
Brief Description *	This policy target defines the fertility rates for the future in regions by 2050. Values are based on the historical period (2005-2020). SELECTION: minimum fertility rates (1), average (2), or maximum (3)

Save Cancel

Figure 120. Edit a Policy Measure

Delete a Policy Measure

The user can **delete a Policy Measure** through:

In the “Policy Measures” window, select a Policy Measure and in the bottom of the page press “Delete”.

HYPOTHESES

In addition to viewing **the list of Hypotheses** through:

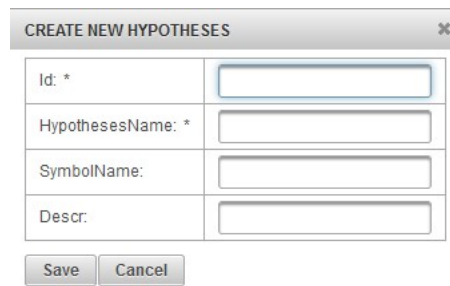
Menu/ Others/ Hypotheses

A registered user can also create new Hypothesis, edit or delete existing Hypotheses.

Create a new Hypothesis

The user can **introduce a new Hypothesis** through:

Menu/ Others/ Hypotheses, and in the bottom of the page press “Create”. The user can add the new Hypothesis in the window that opens (Figure 121Figure 117).



Id: *	<input type="text"/>
HypothesesName: *	<input type="text"/>
SymbolName:	<input type="text"/>
Descr.:	<input type="text"/>

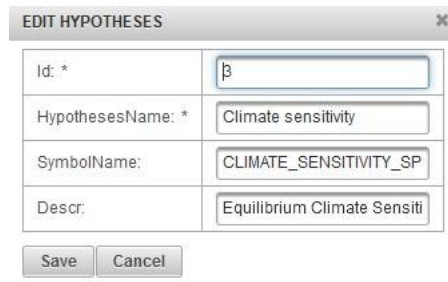
Save Cancel

Figure 121. Create a Hypothesis

Edit a Hypothesis

The user can **edit a Hypothesis**, as it can be seen in Figure 122 through:

In the “Hypotheses” window, select a Hypothesis and in the bottom of the page press “Edit”.



Id: *	3
HypothesesName: *	Climate sensitivity
SymbolName:	CLIMATE_SENSITIVITY_SP
Descr:	Equilibrium Climate Sensiti

Save Cancel

Figure 122. Edit a Hypothesis

Delete a Hypothesis

The user can **delete a Hypothesis** through:

In the “Hypotheses” window, select a Hypothesis and in the bottom of the page press “Delete”.

1.3.3.2.2. STORYLINES

In addition to viewing **the list of Storylines** through:

Menu/ Storylines

A registered user can also create new Storylines, edit or delete existing Storylines.

Create a new Storyline

The user can **introduce a new Storyline** through:

Menu/ Storylines, and in the bottom of the page press “Create”. The user can add the new Storylines in the window that opens (Figure 123Figure 117).



Name: *	
Description:	

Save Cancel

Figure 123. Create a Storyline

Edit a Storyline

The user can **edit a Storyline**, as it can be seen in Figure 124 through:

In the “Storylines” window, select a Storyline and in the bottom of the page press “Edit”.

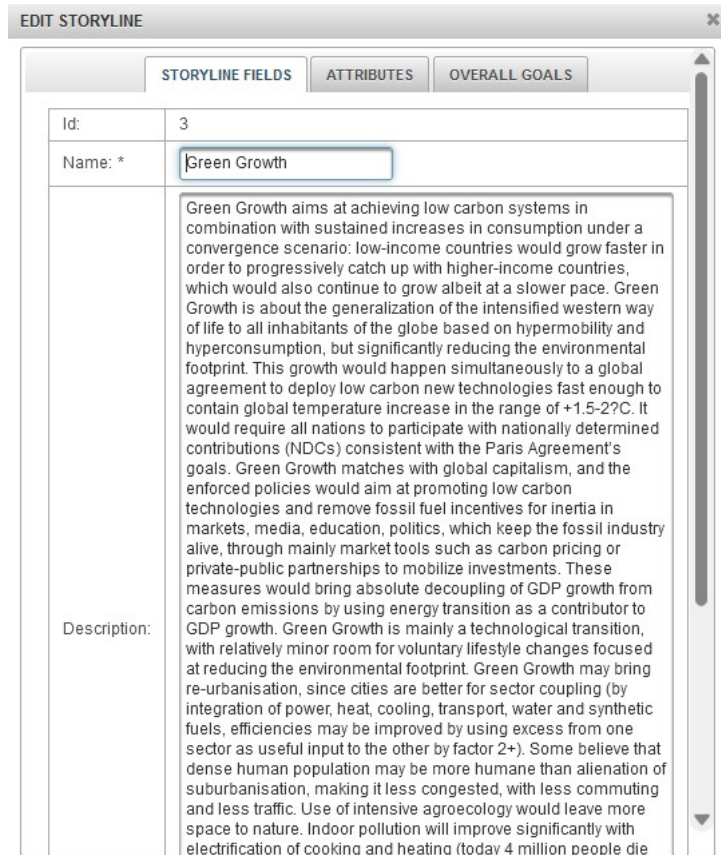


Figure 124. Edit a Storyline

Delete a Storyline

The user can **delete a Storyline** through:

In the “Storylines” window, select a Storyline and in the bottom of the page press “Delete”.

1.3.3.2.3. SCENARIOS

In addition to viewing **the list of Scenarios** through:

Menu/ Scenarios/ Manage Scenarios

A registered user can also create new Scenarios, edit or delete existing Scenarios.

Create a new Scenario

The user can **introduce a new Scenario** through:

Menu/ Scenarios/ Manage Scenarios, and in the bottom of the page press "Create". The user can add the new Scenarios in the window that opens (Figure 125Figure 117).



Figure 125. Create a Scenario

Edit a Scenario

The user can **edit a Scenario**, as it can be seen in Figure 126 through:

In the "Scenarios" window, select a Scenario and in the bottom of the page press "Edit".

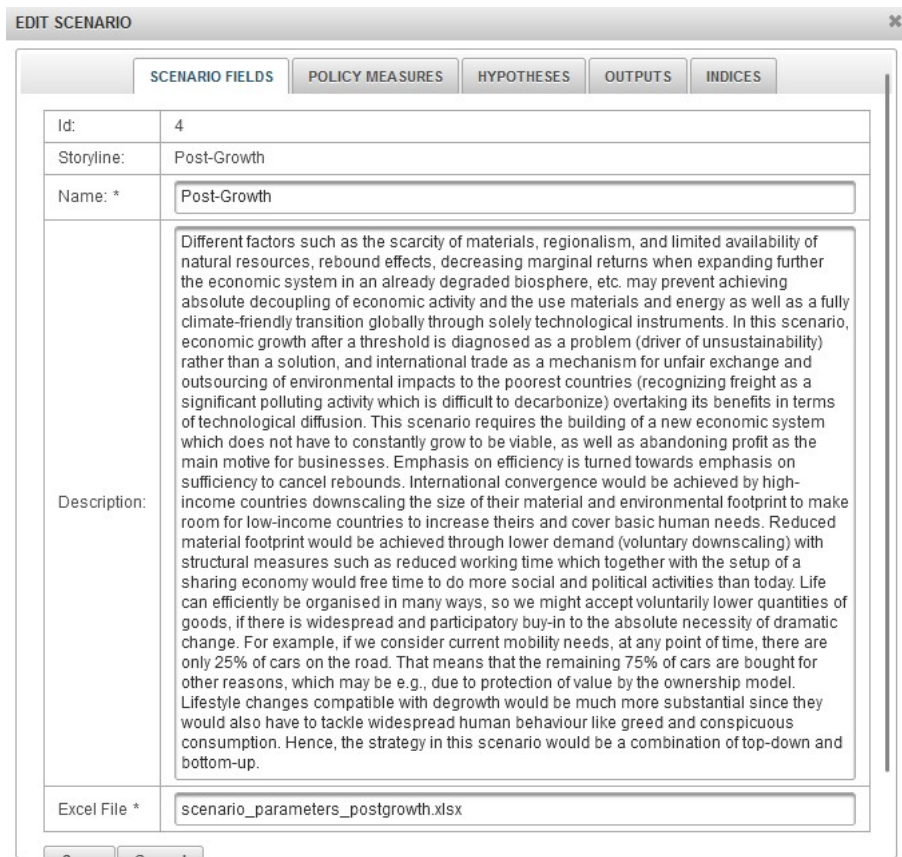


Figure 126. Edit a Scenario

Delete a Scenario

The user can **delete a Scenario** through:

In the “Scenarios” window, select a Scenario and in the bottom of the page press “Delete”.

REFERENCES

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ANNEX I. DESCRIPTION OF THE METADATA FIELDS

Table 2. Metadata fields in WILIAM provides a description of the statistical metadata concepts used for the documentation of statistical data collected and/or compiled within the project, including the fields proposed in the “Guidelines to describe the uncertainty of the WILIAM input parameters” (Roger Samsó and Marc Neumann, 2020) that have been developed as part of WP9 of the project.

Initially, the documentation of metadata for the datasets that have been collected and compiled within the project has been performed in a spreadsheet file. However, in the Data Dictionary, metadata are available for Symbols. In order to facilitate the process, the metadata template has been incorporated in the Data Dictionary allowing modellers to associate the Symbols created within WILIAM with their metadata instead of entering metadata fields manually. The option to Add Metadata for each Symbol directly in the Data Dictionary is also available. Therefore, in the Table below, the reference to “Dataset” is only applicable to the metadata fields of the metadata template spreadsheet file and the reference to “Symbol” is only applicable to the metadata fields in the Data Dictionary.

Table 2. Metadata fields in WILIAM

	Metadata field	Metadata field description	Metadata type	Field properties	Guidelines
1	Dataset/Symbol ID	Identifier assigned to a single dataset/Symbol.	Numerical		
2	Dataset/Symbol name	A name given to the dataset, i.e., any organized collection of data or Symbol.	Text	No length restriction.	Provide a short description of the dataset/Symbol that can be easily understood by users.
3	Main module	The main module that has requested the dataset or the module primarily responsible for the Symbol.	List	Drop-down list with values to choose from.	<ul style="list-style-type: none"> • Energy • Climate • Economy • Finance • Land and water • Materials • Society • Demography • Intermodule consistency • Intro • CP_and_results • Historical and exogenous inputs • Structure
4	Secondary module(s) ²	Secondary module(s) that have requested or intend to use the dataset or the Symbol.	List	Drop-down list with values to choose from.	Same options as in “Main module”.

² Only applicable in the metadata fields for Symbols included in the Data Dictionary and not in the metadata fields created in relation to collected datasets.

	Metadata field	Metadata field description	Metadata type	Field properties	Guidelines
5	Project type of value ²	Type of value of the dataset/Symbol.	List	Drop-down list with values to choose from.	<ul style="list-style-type: none"> • Variable • Historical data series • Model parameter • Constant • Scenario parameter • Index • Index case • Switch • Validity rule
6	Keywords ²	Insert keywords separated by comma to assist the search of Symbols.	Text	No length restriction.	
7	Values read from	Indication of the specific location where the dataset/Symbol values can be found in the model Input files.	Text	No length restriction.	
8	Unit of measure	Unit in which the data values of the dataset/Symbol are expressed.	List	Drop-down list with values to choose from.	The units of measure used for the dataset/Symbol (e.g., Euro, %, number of persons) and the exact use of magnitude (e.g., thousand, million).
9	Statistical concepts, definitions and methodology	Main characteristics of the dataset/Symbol. The method used and operations performed to gather and compile data.	Text	No length restriction.	Describe briefly the main characteristics of the dataset/Symbol in an easily understandable manner and the process and method used to gather and compile data (e.g., data editing, imputation, weighting, adjustment etc.).
10	Source data	Data source(s) where the data have been obtained from.	Text	No length restriction.	Indicate the source of original data.
11	Last source update	Date of last update of the content of the data in the original source.	Date	DD/MM/YEAR	Indicate the date when data in the original source was last updated.
12	Link	Link to the original data source(s).	Hyperlink	Text or combinations of text and numbers stored as text and used as a hyperlink address, such as a Web site URL.	Location where the original data can be obtained from.

	Metadata field	Metadata field description	Metadata type	Field properties	Guidelines
13	Confidentiality/License	Property of data indicating whether they are subject to dissemination restrictions.	List	Drop-down list with values to choose from.	<p>The legislation (or any other formal provision) related to statistical confidentiality applied for the dataset in question.</p> <ul style="list-style-type: none"> • CC BY 1.0 • CC BY 2.0 • CC BY 2.5 • CC BY 3.0 • CC BY 4.0 • CC BY-SA 1.0 • CC BY-SA 2.0 • CC BY-SA 2.5 • CC BY-SA 3.0 • CC BY-SA 4.0 • CC BY-NC 1.0 • CC BY-NC 2.0 • CC BY-NC 2.5 • CC BY-NC 3.0 • CC BY-NC 4.0 • CC BY-NC-SA 1.0 • CC BY-NC-SA 2.0 • CC BY-NC-SA 2.5 • CC BY-NC-SA 3.0 • CC BY-NC-SA 4.0 • CC BY-ND 1.0 • CC BY-ND 2.0 • CC BY-ND 2.5 • CC BY-ND 3.0 • CC BY-ND 4.0 • CC BY-NC-ND 1.0 • CC BY-NC-ND 2.0 • CC BY-NC-ND 2.5 • CC BY-NC-ND 3.0 • CC BY-NC-ND 4.0 • CC0 • CC0 1.0 • CC BY-NC-SA 3.0 IGO • CDLA-Permissive-1.0 • CDLA-Permissive-2.0 • CDLA-Sharing-1.0 • ODC-BY • ODC-BY-1.0 • ODC-ODbL • ODC-ODbL-1.0 • PDDL • PDDL-1.0Public Domain • Other
14	Data collection date	Date of collection of the data.	Date	DD/MM/YEAR	Indicate the date when data were collected.

	Metadata field	Metadata field description	Metadata type	Field properties	Guidelines
15	Time coverage	The length of time for which data have been collected.	Text	xxxx-xxxx (e.g., 1990-2018).	The time period covered by the dataset/Symbol should be described (i.e., the length of time, e.g., from 1990 to 2018).
16	Metadata update ²	Date of last update of the content of the metadata.	Date	DD/MM/YEAR	Indicate the date when metadata was last updated.
17	Contact organisation	The name of the organisation that compiled the data/Symbol or metadata.	Text		The full name or acronym of the organisation.
18	Comments	Supplementary descriptive text and explanation of any special circumstances or other information that may affect the interpretation of the data.	Text	No length restriction.	
	Reliability	Reliability index of the data sources used in data collection.	Numerical	Between 0 and 100.	Index in No 19 has been developed.
19	Reliability of data sources	Result of the survey to identify whether a dataset is suited to be used to generate new data for modelling purposes based on credibility of the author, objectivity/bias, accuracy and reliability and currency and timeliness.	Numerical	Value between 0 and 100.	Value obtained by the YES (value of 1) or NO (value of 0) answers to the reliability dimensions of data sources analysed (automatically calculated in the metadata spreadsheet and by checkboxes in the Data Dictionary).
	Uncertainty ²	Values of the statistical descriptors considered in the uncertainty analysis.	Numerical		The fields described in No 20-39 have been developed to describe uncertainty.
20	Type of input data	Method used to generate data.	List	Drop-down list with values to choose from.	Based on the method used to generate data: <ul style="list-style-type: none"> • Set of values • Model/regression • Expert knowledge • No statistical descriptors added the respective metadata fields have to be filled.
	1) Set of values	The case where parameters are directly derived from data, e.g., data from external databases, from			In case this method has been used to generate data, fields 21-28 have to be filled.

	Metadata field	Metadata field description	Metadata type	Field properties	Guidelines
		literature, from own experimental data of the module developers.			
21	Sample mean	Average of all values obtained with the following expression: $\bar{x} = \frac{1}{N} \sum_{i=1}^N x_i$ $= \frac{x_1 + x_2 + \dots + x_N}{N}$ where $\{x_1, x_2, \dots, x_N\}$ are the observed data and N is the number of data points.	Numerical		
22	Sample standard deviation	Standard measure describing the spread of the data obtained with following expression: $s = \sqrt{\frac{1}{N-1} \sum_{i=1}^N (x_i - \bar{x})^2}$ where $\{x_1, x_2, \dots, x_N\}$ are the observed data, N is the number of data points and \bar{x} is the sample mean.	Numerical		
23	Sample maximum	Maximum value of all sampled values.	Numerical		
24	Sample minimum	Minimum value of all sampled values.	Numerical		
25	Most-likely maximum	Maximum value of the range of likely values for a certain parameter, estimated using previous knowledge of the variable at stake.	Numerical		
26	Most-likely minimum	Minimum value of the range of likely values for a certain parameter, estimated using previous knowledge of the variable at stake.	Numerical		
27	Physical top boundary	Top boundary for values that are not physically possible for certain parameters (e.g., a parameter can only take on positive values ($x > 0$), fractions that must be between 0 and 1).	Numerical		

	Metadata field	Metadata field description	Metadata type	Field properties	Guidelines
28	Physical lower boundary	Lower boundary for values that are not physically possible for certain parameters (e.g., a parameter can only take on positive values ($x > 0$), fractions that must be between 0 and 1).	Numerical		
	2) Model/regression	The case when the module developers are using models and performing regression analysis. Differentiation between the use of external models to WILLIAM which are used to provide inputs into WILLIAM (the parameter inputs considered could be either estimated model coefficients or output variables of the external model) and performing regressions on the module itself (the estimated model coefficients considered as parameter inputs).			In case this method has been used to generate data, fields 29-30 have to be filled.
29	Best estimate	In the case of an estimated model coefficient, the best estimate obtained in the regression. In the case of a regression model output variable, its best estimate obtained in the regression.	Numerical		
30	Stanadard error	In the case of an estimated model coefficient, the standard error is obtained from the regression results (square root of the diagonal elements of the variance-covariance matrix). In the case of a regression model output the information it is contained in the information used for computing associated confidence intervals.	Numerical		

	Metadata field	Metadata field description	Metadata type	Field properties	Guidelines
	3) Expert knowledge	The case where input parameters need to be obtained from expert knowledge by the modelers and module developers.			In case this method has been used to generate data, depending on the level of available knowledge, either fields 31-33 under the schematic pathway have to be filled or fields 34-35 under the statistical pathway based on the modeller's judgement.
	a) Schematic pathway	In the case less knowledge is available.			
31	Lower value	A lower bound considered in a schematic representation of uncertainty.			
32	Upper value	A lower bound considered in a schematic representation of uncertainty.	Numerical		
33	Most-likely value	An upper bound considered in a schematic representation of uncertainty.	Numerical		
	b) Statistical pathway	In the case more knowledge is available.	Numerical		
34	Best estimate	A most likely value considered in a schematic representation of uncertainty.	Numerical		
35	Standard deviation	In a statistical representation of uncertainty, the best estimate, i.e., expected value of a distribution.	Numerical		
	4) No statistical descriptors added	No statistical descriptors are included.	Checkbox	Checkbox.	Check box if no statistical descriptors are included. In the case no statistical descriptors have been added fields 36-38 have to be filled.
36	No statistical descriptors - explanation	Explanation of the reasons why statistical descriptors could not be provided.	Text	No length restriction.	Short description/explanation of the reasons why no statistical descriptors could be provided.

	Metadata field	Metadata field description	Metadata type	Field properties	Guidelines
37	Qualitative appraisal of the uncertainty	Qualitative appraisal of the uncertainty of the parameter.	Text	No length restriction.	Provide a short qualitative description of the uncertainty of the parameter.
38	Probability distribution	Name of the distribution and the coefficient values of the parameters in case the distribution is other than uniform, beta-PERT/triangular, normal, log-normal.	Text	No length restriction.	Provide information on the name of the probability distribution and the coefficient values in case the distribution is other than uniform, beta-PERT/triangular, normal, log-normal.

Source of definitions: (Eurostat, 2020, 2015, 2014; Roger Samsó and Marc Neumann, 2020; Sdmx, 2019, 2013, n.d.)