

MEDEAS User guide

(Vensim Reader)

(February 2017)

Iñigo Capellán-Pérez

Ignacio de Blas Sanz

Research Group in Energy, Economy & System Dynamics of the University
of Valladolid



MEDEAS

MODELING THE RENEWABLE ENERGY TRANSITION IN EUROPE

Summary

This document explains how to run a published version of a model using the freeware Vensim Reader. MEDEAS model is implemented in Vensim, and includes an excel template that operates as an interface that allows for those users not familiar with Vensim to design and run their own scenarios.

Table of contents

1. Introduction	3
2. Download Vensim Model Reader	3
3. Use of Vensim Model Reader	3
4. Download model and associated files:	3
5. Open model	4
6. Run of scenarios	4
6.1. By-default scenarios	5
6.2. Customized scenarios	7
6.3. Modify the structure of the model	9
7. Visualization of results	10
8. Appendix for users using Vensim DSS	10

1. Introduction

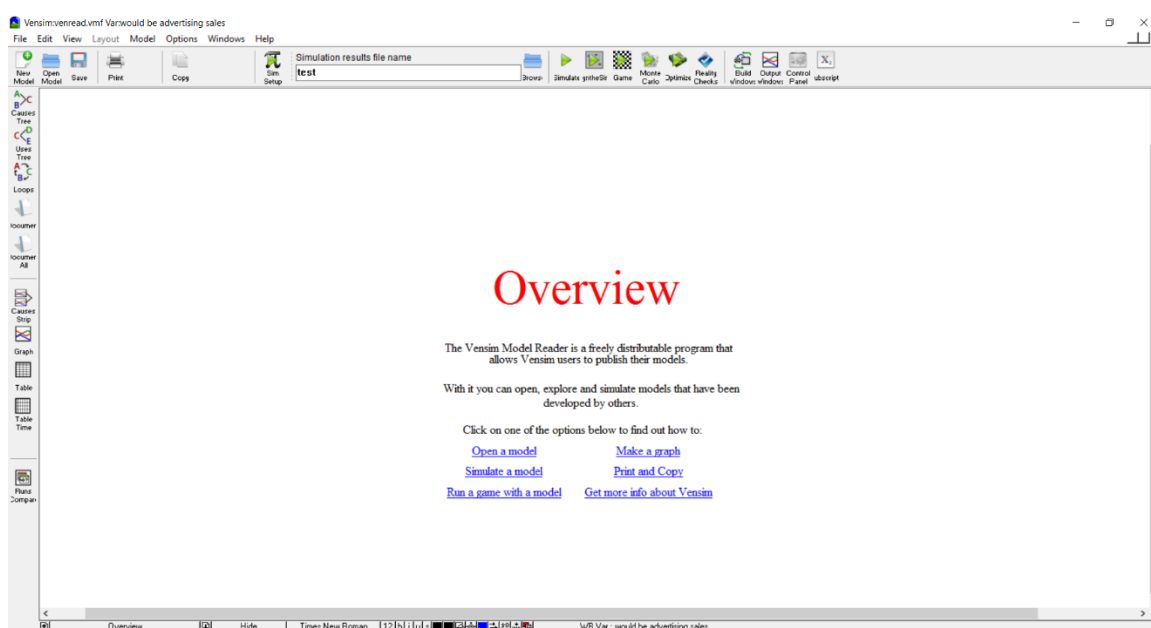
This User's Guide explains the basic software requirements and knowledge for any user to be able to run the MEDEAS model with freeware Vensim Reader.

2. Download Vensim Model Reader

Follow instructions and download here: <http://vensim.com/vensim-model-reader/>.

3. Use of Vensim Model Reader

For beginner users using the freeware Vensim Reader software, when opening the software after the installation a short tutorial will appear. It is recommended to follow it to learn the basics (e.g. represent a result in a graph) and get familiar with the tool:



4. Download model and associated files:

When downloading and uncompressing the file **Demo-MEDEAS-Brno.zip**, the following files can be found:

[Please note that this is not *the* MEDEAS model, but just a couple of modelling structures to get familiar with the modeling tool]





 inputs.xlsx	06/02/2017 14:53	Hoja de cálculo d...	446 KB
 MEDEAS-demo.mdl	09/02/2017 9:57	Vensim model (M...	22 KB
 MEDEAS-demo.vpm	09/02/2017 9:57	Vensim packaged ...	54 KB
 MEDEAS-Vensim_User_guide.pdf	09/02/2017 10:00	Documento Adob...	1,919 KB

Figure 1

MEDEAS-demo.vpm allows to open, explore and simulate the model with the freeware “Vensim Model Reader”.

The file **inputs.xlsx** stores the input data required for running the by-default scenarios and creating new ones. This file contains a tab “README” and “Info input variables” which document the way the variables are organized and defined in the data sheet. IMPORTANT: Do not modify the name of the excel file neither those of the tabs since the paths with Vensim are not dynamically set.

*Additional software requirements: A version of Microsoft Excel allowing to work with tabs.

[**MEDEAS-demo.mdl** is the full model programmed in Vensim, which allows to open, explore, simulate and modify the structure of the model. To open and work with this file, the proprietary software Vensim DSS version or superior is required (<http://www.vensim.com>). More information about this version is available in the Appendix in section 8).

5. Open model

Once the software installed and the short tutorial completed, open the model (file **MEDEAS-demo.vpm**) with Vensim Reader. The first view should then appear relative to the socioeconomic variables “GDP and Population”. Note that the variables and graphs appear empty since no simulation has still not been run.

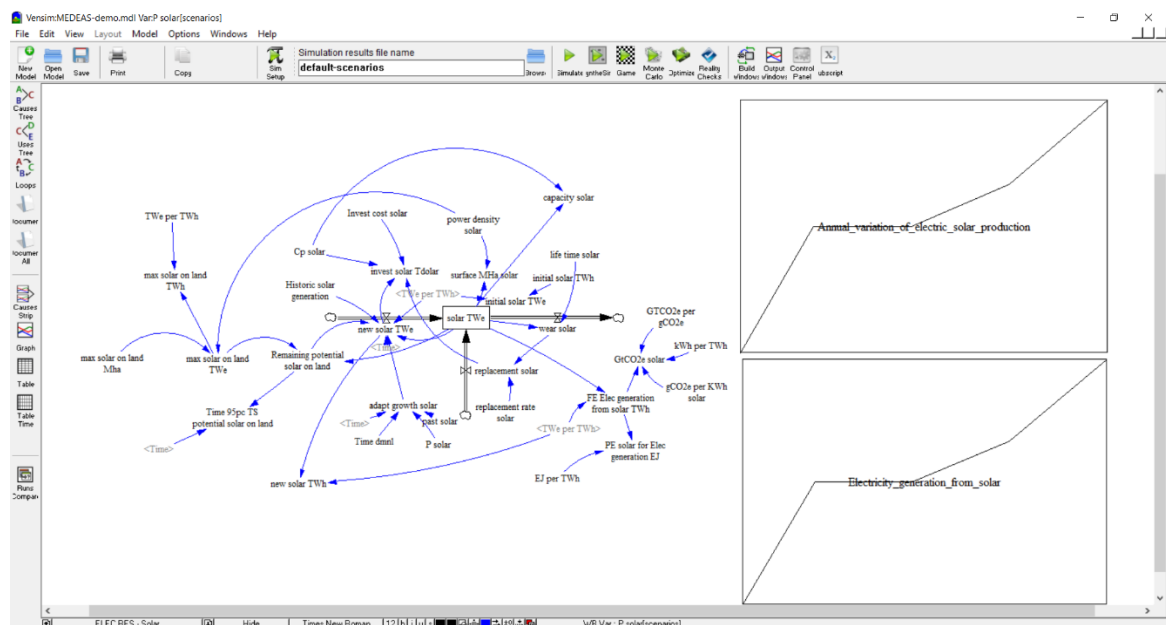


Figure 2

6. Run of scenarios

This model version is programmed vectorially, so 6 scenarios (User define, BAU, SCEN1, SCEN2, SCEN3 & SCEN4) are always run in parallel. The user can select which one(s) to represent.

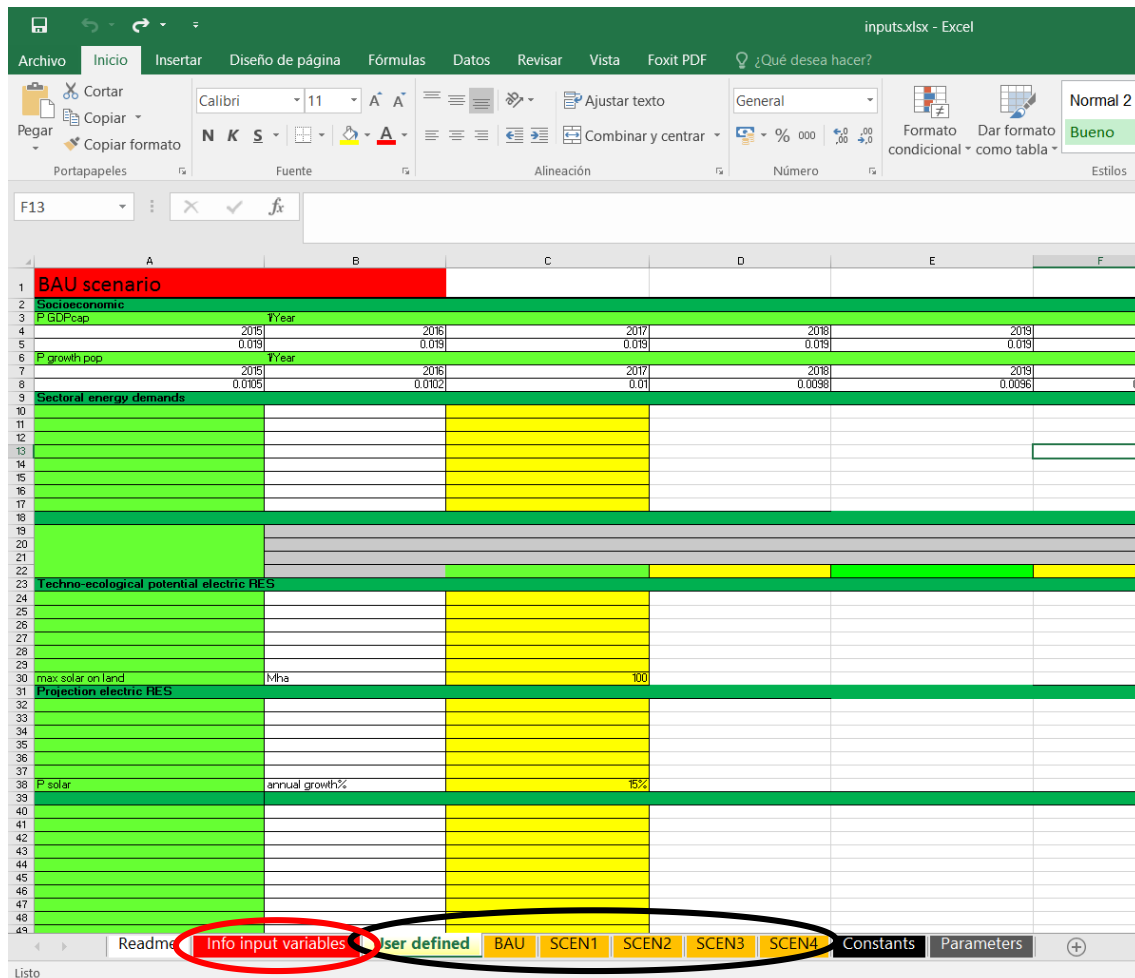
6.1. By-default scenarios

To run the by-default scenarios just press the button *Simulate*, located in the upper part of the screen. Vensim will simulate the 6 scenarios mentioned above using data from **inputs.xlsx** (which approximatively correspond, in the full version of the model in-development, to the scenarios published in Capellán-Pérez et al., (2014)).



Figure 3

The input data for the scenarios are taken from the file **inputs.xlsx** (be sure that this file is opened when simulating –if it does not open it automatically open it then manually). For each scenario there is an independent sheet. In each scenario, different assumptions are made for each input. For a description of each variable in the excel, see the red tab “info input variables”. Note that each variable is named equally in both the excel and Vensim.



This tab includes a description of each variable

Each tab contains data for a scenario

Figure 4

In this model example, just 4 inputs are loaded per scenario: “P GDPcap”, “P growth pop”, “max solar on land” and “P solar” (see Figure 4). The rest are either Constants or Parameters.

If the simulation has succeeded, the view will now show the trajectories of the variables in the graphs (in this view GDP and Population):

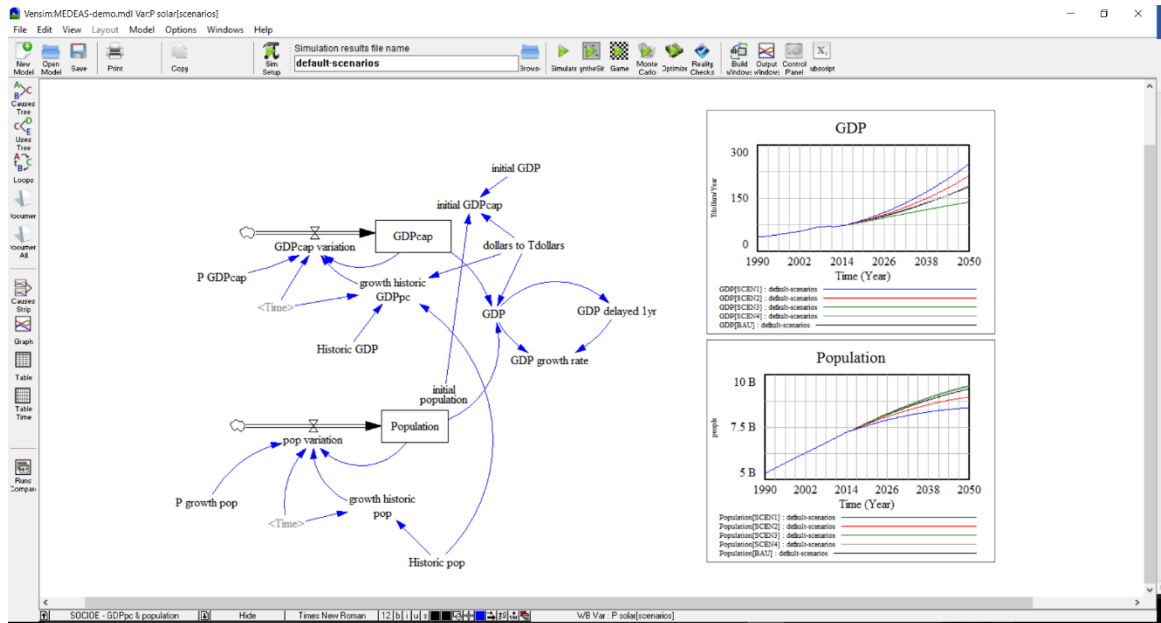


Figure 5

To see the next view showing the modelling of electricity generation from solar use the “Page up” (“Page up” to return), or click in the arrow in the bottom left area of the screen:

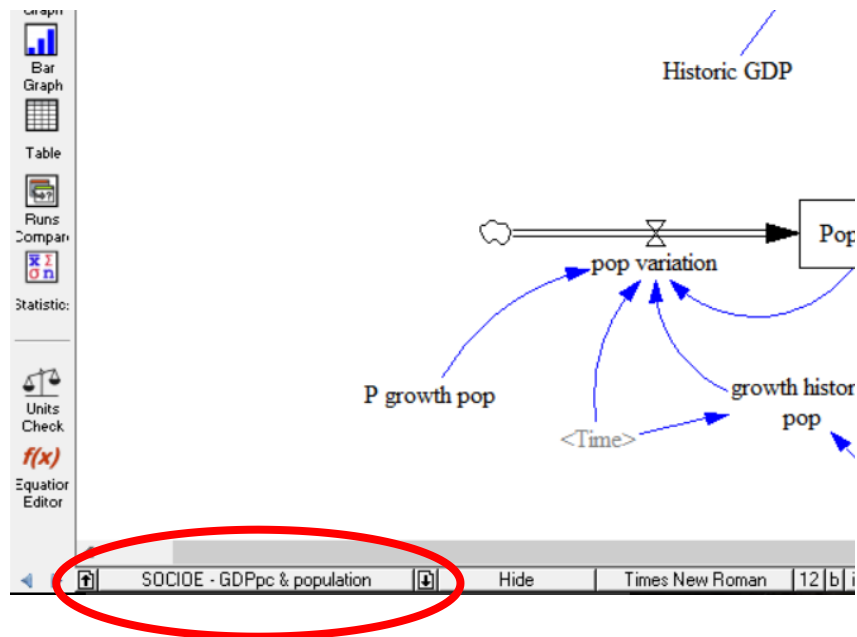


Figure 6

The output of the simulations is stored in a .vdf file: **default-scenarios.vdf**.

6.2. Customized scenarios

It is possible to build a customized scenario by modifying the inputs in any tab of the file **inputs.xlsx** with both the “Vensim Model Reader” and the “Vensim DSS” versions.

There are 3 different ways of modifying inputs:

1. Introducing a numerical value: zooming Figure 4 we see that we can modify the inputs “max solar on land” (100 Mha by default) and “P solar” (15% by default); *[try for example with 200 Mha and 30% annual growth]*:

22			
23	Techno-ecological potential electric RES		
24			
25			
26			
27			
28			
29			
30	max solar on land	Mha	100
31	Projection electric RES		
32			
33			
34			
35			
36			
37			
38	P solar	annual growth%	15%
39			
40			
41			

Figure 7

- Introducing a time series (e.g. variables “P GDPpc” and “P growth pop” in lines 4-5 and 7-8 in next figure [it is possible to introduce dynamic formulas in the excel to test different growth rates of GDP, for example]):

	2015	2016	2017	2018
P GDPpc	0.019	0.019	0.019	0.019
P growth pop	0.0105	0.0102	0.01	0.0098

Figure 8

- While for others a choice has to be done between different options, e.g. “Selection of conv oil curve” selecting the option 1,2, 3 or 4 (in the example in Figure 9, the option 2 “Maggio12 High” is selected –see black bold circle- although this case is not in the model example in **Demo-MEDEAS-Brno.zip**):

	1. Maggio12 middle	2. Maggio12 High	3. Maggio12 Low	4. User defined in '93A'
Selection of conv oil curve		2		

Figure 9

The rest of variables used by the model which remain constant through the by-default scenarios are located in the sheets “Constants” and “Parameters”:

- *Constants*: units conversion, historical values, etc.
- *Parameters*: variables that are considered as constants in the by-default simulations but that may be different following other assumptions.

For comparing the results of our User Defined scenario, it is necessary to change the default options in Vensim. For this, click in the “Subscript” button:

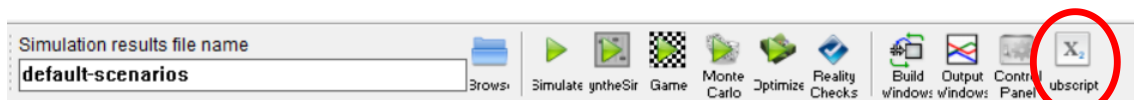


Figure 10

And in the tab “scenarios” we select the scenarios that we want to visualize (e.g. it is possible to run the “User define” scenario and compare with the by-default scenarios):

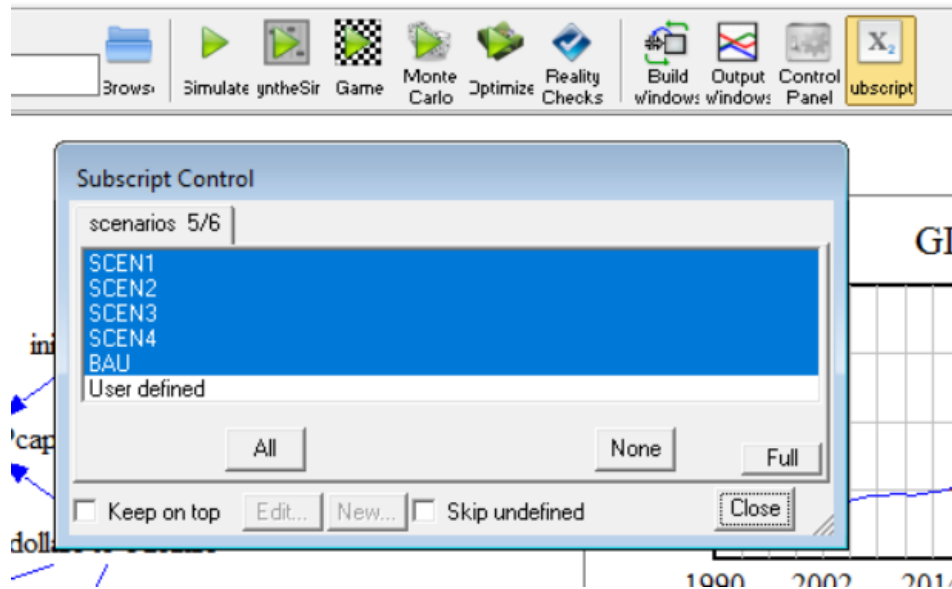


Figure 11

If different simulations are made, the user can remove and or select the ones to be displayed clicking in the option “Control panel”. In the example below, two scenarios have been run, but only the “default-scenarios2” will be displayed:

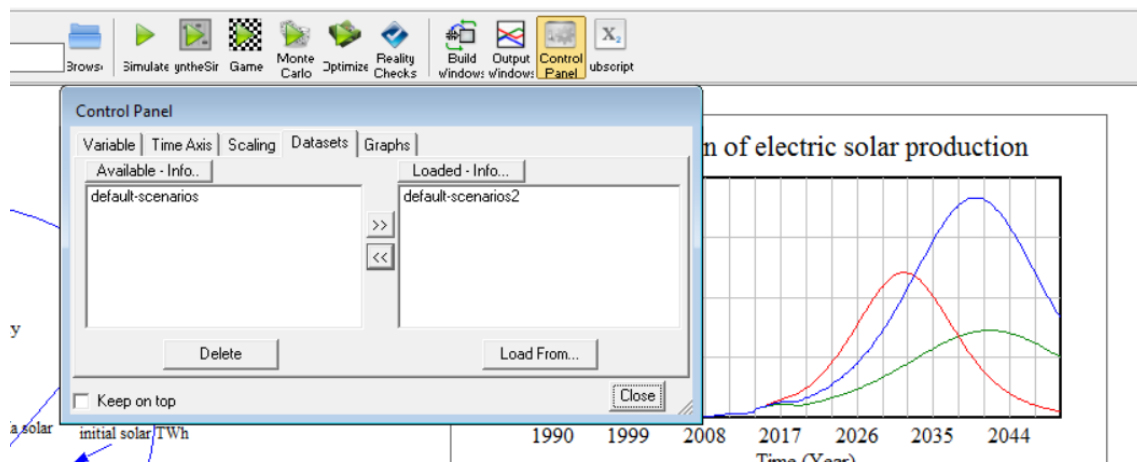


Figure 12

6.3. Modify the structure of the model

Users are welcomed to modify the structure of the model in Vensim as well as the input data file "inputs.xlsx". For this, the proprietary software Vensim DSS version or superior is required (<http://www.vensim.com>); “Vensim Model Reader” will not allow to make changes in the structure. For preventing the model from crashing, users just have to make the modifications in both files (excel and Vensim) consistently.

7. Visualization of results

The user can use the Vensim tools to visualize the trajectories of any variable (following the 3 steps described in Figure 13). Outputs of any variable can be exported using Vensim usual tools.

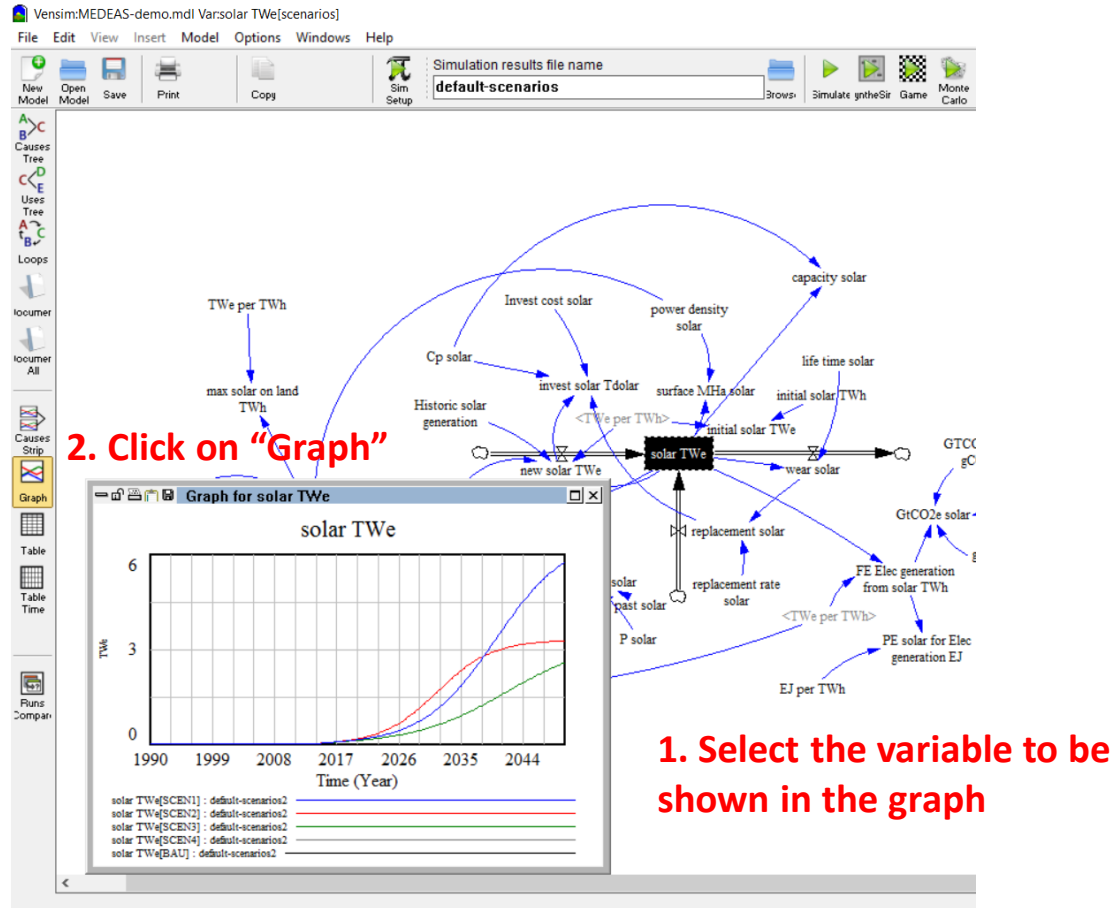


Figure 13

8. Appendix for users using Vensim DSS

Note: RK4 integration type is recommended (Model-Model Settings).

For example, for the variable "P solar", which represents the annual growth in energy output demand from solar electric technologies, data from the C38 cell (circled in black bold) from the scenario BAU (in red, sheet "BAU") are required. Vensim reads the excel file **inputs.xlsx** as follows:

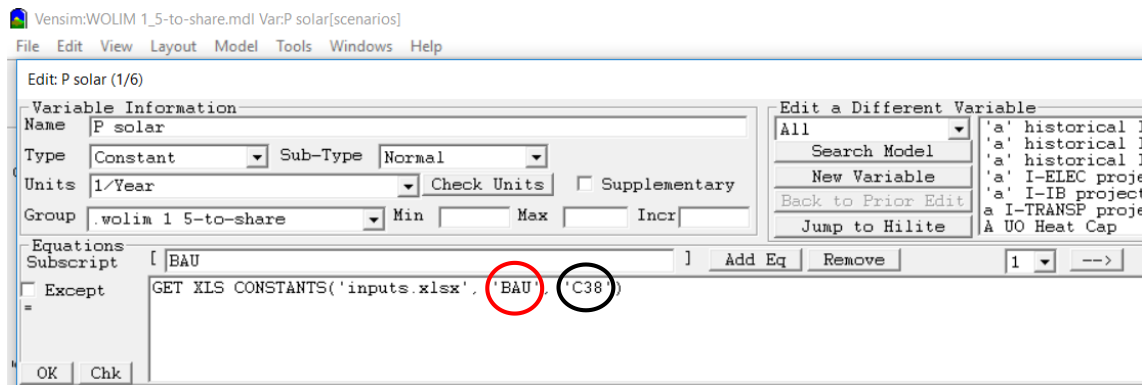


Figure 14

Tab “BAU” and cell “C38” in excel file (see Figure 7).

References

Capellán-Pérez, I., Mediavilla, M., de Castro, C., Carpintero, Ó., Miguel, L.J., 2014. Fossil fuel depletion and socio-economic scenarios: An integrated approach. *Energy* 77, 641–666. doi:10.1016/j.energy.2014.09.063