MODEL OF SIMULATION AND ANALYSIS OF THE ENERGY MATRIX - SAME

BASIC USER GUIDE

The following guide indicates step by step the basic options provided by the SAME Model to generate energy prospective scenarios in a specific study horizon.

1. FILE

1.1.   Select the option "New case"

1.2.   Enter the information of the new case: Name and Description in the displayed window.

1.3.   Save the case information in the respective window

1.4.   Save the case (File/save)

2. CONFIGURATION – Basic options

2.1.   Define the study horizon by marking the projection years (Configuration / Basic options / Study horizon).

2.2.   Select the base year of the study, the reference unit and the discount rate (Settings / Basic options / General information).

2.3.   Define the regions to simulate (Settings / Basic options / Regions)

2.4.   Activate the energy chains that apply to the region or regions to be simulated. Both the chains in force in the base year and those that could come into effect in a future year of the study horizon must remain active. The cells of the table with a gray background correspond to non-existent relationships or chains, which, if required, must be defined in the "Configuration / advanced options / definition of energy chains" window. When defining a new energy chain, it is necessary to enter its GHG emission factor and if the chain is for final consumption, its relative efficiencies must also be entered.

2.5.   Initially, the configuration, data entry and projection processes will be carried out for the base scenario of the study that is defined by default in the SAME Model (code 1).

3. DATA ENTRY

3.1.   Enter the energy balance data for the base year for each type of energy activity. Take into account that by default the units of all energy sources, like the reference caloric unit, are in ktoe (thousands of equivalent tons of oil), therefore, the caloric factors of all energy sources are equal to unity. If you want to change the reference caloric unit (in the General Information window), the caloric factors of the energy sources must be updated (Settings / advanced options / Energy sources).

From the OLADE Energy Information System (http://sielac.olade.org/), you can download the energy balance of the OLADE member country that you want to simulate, in Excel format, in caloric units (for example, ktoe) and import it directly to the data entry windows through the respective button on the options bar (Import).

Given that the electricity generation of public power plants is aggregated in the energy balance, when importing the balance to SAME, an estimated disaggregation is made based on the average efficiencies of each technology. For this reason, it may be necessary to adjust the electricity flow of each technology to bring the energy balance in the base year.

3.2. Enter the installed capacities of the activities of the supply and transformation type, that you have available for the base year. At least you should enter the electricity generation capacities by type of plant in MW. SAME includes an option in the Projection Module to estimate the required installed capacity based on energy flows, once the projection of the offer by technical coefficients has been carried out.

3.3. If you want to obtain results of the economic costs of the energy supply for each scenario, you must enter the unit costs for the supply and transformation activities. These unit costs can be differentiated by variable costs, fixed operation and maintenance (O&M) and investment costs. This information is generally available only for power generation technologies. If levelized cost of energy (LCOE) information is available, they should be entered as variable costs, leaving the other types of costs at zero, since investment costs and fixed O&M costs are already considered in the LCOE.

3.4. If information is available on the proven reserves of the different fossil sources and primary minerals for the base year, they must be entered in this window, so that after the simulation, it can be verified in one of the graphs if they are Proven reserves will be sufficient to cover the accumulated production of the mentioned type of sources in the study period.

3.5. Enter the maximum demand for electrical power corresponding to the base year. If this information corresponds to the consumption side, it will be necessary to enter a total percentage of transmission and power distribution losses to calculate the generation capacity requirements. If the maximum demand information was measured at the generator terminals, the loss percentage must be zero.

3.6. Exogenous variables: if the option with which the energy demand will be projected is through econometric models, the information of the exogenous variables that are part of the mathematical expressions (defined in the Configuration Module) that will be associated to the different final consumption flows in the projection module).

3.7. Extensive variables: if you want to project a certain energy consumption, using extensive variables of said consumption (analytical models) it is necessary to enter the projection of these extensive variables in the study period and the structure or percentage contribution of the participation of the different technologies consumption in the coverage of each extensive variable.

4. PROJECTION – Basic options

4.1. Projection of demand by growth rates: the basic option of projection of energy demand in SAME consists of entering average annual growth rates for each of the energy flows of the sectorial consumption. These rates can be extracted from complex statistical models external to the SAME model or extracted from historical series downloaded from the OLADE Information System. In the final consumption projection window with annual growth rates, the entered rates can be constant for the entire projection period or different values can be entered for each year of the projection period. Other demand projection options can be found in advanced options such as: through time functions, through econometric models (exogenous variables) and through analytical models with extensive variables.

4.2. Percentages of own consumption and losses: in this window the percentages with respect to the total supply of each of the energy sources must be defined, which correspond to own consumption and losses (in energy). When the selected scenario is the base scenario (the one that comes by default), the second column of the table corresponds to the percentages calculated from the energy balance of the base year. If the user wishes to keep these same percentages for the projection period, they must click on the "Replicate root year" button in the options bar of the window. For alternative scenarios, the second column of the table will show the percentages in the root year of the scenario, that is, of the branching year of the selected scenario.

4.3. Projection of the demand by technical coefficients of useful energy: this option can be used only after having previously carried out a projection of the energy demand with any of the options mentioned above. Since its function is to calculate and then apply the percentage structure of participation of each of the technologies and consumption sources, in the coverage of the useful energy of each end use. The calculation of the useful energy is carried out using the information on the final consumption obtained through a previous projection of the energy demand and the relative efficiencies of consumption, which were defined in the advanced options of the configuration module. Then this structure can be modified in the Simulation Module or directly in the respective window of technical coefficients available in the advanced options of the Projection Module, which allows to simulate substitution of sources or technologies in a specific end use, maintaining the same useful energy original. The greatest usefulness of this window is to simulate an evolutionary scenario of energy demand from the base or initial year of the scenario to a future year where substitutions of sources or technologies have been made through the control panel of the Simulation Module, maintaining the useful energy invariable. For this, the projection is run with the third option selected (Calculate and use evolution of the technical coefficients in the projection period).

4.4. Projection of electrical power demand: this variable can be projected through two available options, the first is using the system load factor which is calculated for the base year and can be considered constant for the entire projection period. By knowing the average power demand, calculated from the electricity consumption, the maximum

power demand can be calculated. The second option is entering an annual growth rate. It is advisable to project the maximum power demand after having projected the electricity supply.

4.5. Projection of the supply by technical coefficients: once the energy demand has been projected, it is advisable to project the supply using the first option provided by the window "Calculate and use technical coefficients of the root year of the scenario". Since in this way the technical coefficients are calculated from the base year information and a trend scenario of the energy supply is obtained very easily.

The following 3 options are useful once some type of modification of the structure of the energy matrix has been simulated using the control panel (Simulation Module) or the technical supply coefficients have been manually modified (advanced options of the Projection Module). The fifth option is used when it is desired that the supply projection is restricted to the availability of installed capacity and dispatch priority of each energy supply technology (supply and transformation activities). It must be taken into account that to use this option, information must be available on the installed capacity of each activity and supply and transformation technology and its dispatch priority.

4.6. Priority of the electricity supply: as a preliminary step to projecting the energy supply with priority and capacity restriction, the basic options of the projection module provide a window to adjust the dispatch order or priority of electricity generation technologies, since the SAME Model predefines an order when the technical coefficients are calculated in the trend supply projection (first option of the supply projection by technical coefficients). If you want to change the priority of other supply and transformation activities, you must open the windows corresponding to the technical coefficients in the advanced projection options.

4.7. Projection of the installed capacities of the energy supply: to carry out this projection there are two methods, the first allows calculating the required capacity of each supply technology to cover the energy flow that was previously projected with any of the first 4 options of the projection window of the offer by technical coefficients. By using this type of capacity projection, the base year of the prospective study can also be included in the calculation, which is useful for technologies for which information is not available for that year. The second option corresponds to the projection of the installed capacity, when there is a schedule for the installation or withdrawal of capacity during the study period. It is to project the capacity of all energy supply and transformation technologies, before using the fifth option in the window "Projection of supply by technical coefficients" (use priority and capacity restrictions ".

4.8. Projection of leveled energy costs: if information on leveled energy costs for the base year (LCOE) was entered, said costs can be projected in the study period by using annual growth rates (inflation rates). The options to project the differentiated costs in variable, fixed O&M and investment costs, are available in advanced options of the projection module.

5.   SIMULATION

5.1.   Once the energy demand and supply projection process for the base scenario is completed, you must return to the Configuration Module, to the "Scenarios" window and create an alternative scenario as a branch of the base scenario from a certain year. When saving the information of the new scenario, the Model will ask if you want the new scenario to inherit the information of the parent scenario from its initial year. Reply to this message affirmatively. In this way, the new scenario will become a copy of the parent scenario.

5.2.   Consumption Simulation: in the Simulation Module, enter the final consumption control panel and select the base scenario of the study as the reference scenario and the alternative scenario as the simulated scenario. Select the simulation year, which can be the last year of the study period. In the final consumption control panel, substitutions of energy sources and technologies for a specific end use can be simulated. For the substitution, the energy flow of a certain source can be reduced by means of the scroll bars and substituted by another while maintaining the same useful energy of the reference scenario. For this effect, click on the button with the symbol "=" on the right side of the scroll bar of the substitute source, causing the model to calculate the amount of energy flow from this source necessary to recover the original useful energy.

5.3.   Simulation of supply and transformation: by moving the flows of energy consumption, the balance in the energy balance of the modified sources will be affected, either by deficit or oversupply. Depending on the type of source, the balance in the energy balance can be restored by modifying the flows of transformation products and / or supply. For example, if after the replacement of a source or final consumption technology with another source or more efficient technology, the consumption of the substituted source is reduced, an oversupply may appear in the energy balance of said source. If there are imports from this source, the logical thing is that, through the supply control board, imports are reduced to eliminate this oversupply.

5.4.   In the transformation board, substitutions of electricity generation technologies can also be simulated, this can also alter the balance of the energy balance of the inputs to these technologies. These imbalances can be eliminated by modifying supply activities or other transformation activities. In the case of supply and transformation activities, the button with the "=" sign to the right of the scroll bars is used to automatically regain balance in the balance of the energy source corresponding to said scroll bar.

5.5.   Once the balance of all energy sources has been recovered in the energy balance for the year simulated in the control panels, it is possible to return to the Projection Module and use the demand projection window "By Technical Coefficients of Useful Energy" and by the third projection option, it will be possible to gradually evolve the consumption between the initial year of the alternative scenario and the final year of the projection period, maintaining the original useful energy in each year.

5.6.   Once the evolutionary demand scenario has been built, the evolutionary projection of the offer can be carried out for the alternative scenario, entering the window "Projection of the Offer by Technical Coefficients" and projecting the offer with the third projection option.

5.7.   After the evolutionary projection of energy demand and supply, a projection using priority and capacity restrictions could also be run for the alternative scenario.

6.   REPORTS AND GRAPHICS

Once the projection of the base and alternative scenarios is completed, the different reports and graphs available in the SAME Model can be obtained in order to carry out a comparative analysis of the different indicators of the energy matrix of both scenarios.

7.   NOTE

A detail of the functions of each window of the Model can be found in the help files that will be displayed by clicking on the "Help" button in their respective option bars.