

How to Re-run the Model

To gain a thorough understanding of OSeMOSYS and the CCG ClicSAND interface, there is an Open University training course in Energy and Flexibility Modelling: OSeMOSYS & FlexTool available here: <https://www.open.edu/openlearncreate/course/view.php?id=8395>. The CCG-SAND interface was created by Carla Cannone based on the energy modelling tool OSeMOSYS, to organise input data via an Excel-based graphical user interface. Once the required data, such as capital costs and operational life are inputted, the CCG-SAND interface produces a text file as the output. The Starter Data Kit ([Selected 'Starter Kit' energy system modelling data for Egypt \(#CCG\) | Research Square](#)) automatically has this data in the base file for Egypt. This data can be updated if needs be. The scenarios run in this analysis are based on the data from the SDK, and the clicSAND files for each of the six scenarios can be found on Zenodo. This text file is converted to an OSeMOSYS cloud version which is inputted into the online version of OSeMOSYS, producing a results folder that contains a csv Excel file. This file contains the results for specific parameters such as the total annual capacity and total CO₂ emissions. The data within the csv file are transferred to an Excel spreadsheet containing the results template where graphs can be created to present the final results. Below is a step-by-step guide to first running the model, based on the Open University Hands-On exercises 1, 2 and 3 (Tan *et al.*, 2022).

Learning aims

1. Install Mono framework for Mac
2. Install gcc, cbc and glpsol
3. Install clicSANDMac
4. Run a scenario using clicSANDMac
5. OSeMOSYS Cloud
6. Results Visualisation

Install Mono framework for Mac

1. Download Mono with this website <https://www.mono-project.com/download/stable/>. Click on 'Download Mono 6.12.0 (Visual Studio channel*)' to start the download. The Mono package will be in your Downloads folder. Click on it. Click on 'Continue' and 'Agree' in the pop-up screen until you see 'Install'. Once clicked on 'Install', the installation process is complete and can click 'Close'. 'Move to Trash' to finish.

Install gcc, cbc and glpsol

2. To install gcc, you need to run a command in a terminal. Click on command + space bar to activate spotlight search and type in "terminal" and click or press enter on the first option. Copy and paste this command into the terminal: 'xcode-select --install' and hit enter. Then click on 'Install' and 'Agree'. Once the pop-up stating installation is complete, click on 'Done'. To install cbc and glpsol, copy and paste the commands from <https://raw.githubusercontent.com/ClimateCompatibleGrowth/clicSANDMac/main/install.sh> to your terminal in one go and press enter.

Installing clicSANDMac

3. Download the latest clicSANDMac.zip from here: <http://doi.org/10.5281/zenodo.5879056>. The zip file will be in your downloads folders. Unzip it by clicking on it. A pop-up screen will

appear stating macOS cannot verify the developer of clic-SANDMac.pkg. Click 'Open'. Click 'Continue' and then 'Install'. Once the installation was successful, click 'Close' and then 'Move to Trash' to finish. clicSANDMac will be in your 'Applications' folder.

Run a Scenario using clicSANDMac

4. Open clicSANDMac in your Applications folder. The clicSAND pop-up will appear, click on 'Export Templates' and direct to a folder for your scenario, e.g. LCEgyptScenario. This automatically saves a blank copy of four files: CCG-SAND Interface v.12.xlsm, OSeMOSYS_code.txt, Results Databased.accdb, and ResultsTemplate.xlsm. The six CCG-SAND Interface files from this analysis can be found on Zenodo: Egypt LCv2 SAND LCnobia, Egypt LCv2 SANDFFF, Egypt LCv2 SAND NZ2050, Egypt LCv2 SAND ISES2035, Egypt LCv2 SAND IRENA2030 and Egypt LCv2 SAND60by2035.
5. Go to the 'ToDataFile' sheet in the SAND interface of one of the 6 scenarios, for example the LC scenario. Click on the top left corner of the spreadsheet which selects all data within the sheet. Right click and copy. Paste this data from the ToDataFile into a 'New Document' of the TextEdit app. Save your new TextEdit file with a related name e.g. LCEgyptScenario in your related folder and close it. We now have a .txt file. Now go to 'Applications' folder and open clicSANDMac.
6. The same clic-SAND pop-up will appear – click on the three-dot button [...] on the right of the Data Source (txt) to upload your txt file made in the previous step. The three-dot button below to the right of the Model will always be the OSeMOSYS_code.txt file that was automatically generated when clicking on Export Templates previously in Step 4. Once these two files have been selected, click 'Run'. You will see whether the run has been successful in the clicSANDMac pop-up. This generates 3 new files in your designated folder for the LC scenario.

Results visualisation

7. Download the conversion.app.zip here: <http://doi.org/10.5281/zenodo.5879056>. Once downloaded, unzip and open the file. This file will convert the results txt file into a csv file. Once the pop-up window has opened, choose the LC results txt file generated in Step 6. Choose an output name – LC_results and save this output name. Click on 'Run' to finish. A csv file will be generated in the LC folder. Open the file and copy all the data.
8. Open the Results Template file in the LC folder. Delete the example data and paste your results into the spreadsheet.
9. There are several tabs to visualise your results, such as Annual Electricity Production, Electricity Production by Timeslice, Annual Total Capacity, Annual CO₂, Demand and Capital Investment to name a few.

OSeMOSYS Cloud

10. To run OSeMOSYS online, open the clicSANDMac application and the Conversion app. Click on the three dot [...] button on the right of the Data Source as in Step 6 and open the SAND file you want to visual.
11. Then click on Generate OSeMOSYS cloud input.
12. Go to OSeMOSYS cloud online (<https://www.osemosys-cloud.com/>), create a new model, and new run. For the model file use the osemosys_code_cloud txt file, then for the Data file use the txt file that was just generated by clicSAND (ending in .xlsm.txt.cloud_data.txt)

13. Server type: large, and uncheck 'Send me an email', then click Start Run. The reference energy system (RES) will be generated immediately.
14. To view graphs online, click the blue graph button and to view graphs offline, click Result (NOT Results CSV)
15. The generated file can then be inserted into the Conversion app (follow Steps 7-9).

References

Tan, N., Cannone, C., Kell, A., Howells, M. (2022). Hands-on 1 (macOS): Energy and Flexibility Modelling. <http://doi.org/10.5281/zenodo.5920392>

Tan, N., Cannone, C., Kell, A., Howells, M. (2022). Hands-on 2 (macOS): Energy and Flexibility Modelling. <http://doi.org/10.5281/zenodo.5920425>

Tan, N., Cannone, C., Kell, A., Howells, M. (2022). Hands-on 3 (macOS): Energy and Flexibility Modelling. <http://doi.org/10.5281/zenodo.5906642>