Energy and Flexibility Modelling

Hands-on 10

Please use the following citation for:

- **This exercise**

- **clicSAND Software**

- **OSeMOSYS Google Forum**

Please sign up to the help Google forum here. If you are stuck, please ask questions here. If you get ahead, please answer questions in the same forum. Please state that you are using the 'clicSAND' Interface.

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Learning outcomes

By the end of this exercise, you will be able to create and run the following scenarios in OSeMOSYS:

1) Fossil-Future Scenario

2) Least-Cost Scenario

3) Net Zero Scenario

Fossil Future Scenario

The Fossil Future Scenario will show what would happen if no renewables technologies were used in the energy system, with only technologies emitting carbon dioxide addressing the final energy demand. This can be thought of as the worst-case scenario in relation to climate change.

We will use the parameter **Total Annual Max Capacity Investment** to constrain the activity of renewable technologies.

Try it:

1. Go to Parameters and in Column A filter out for **TotalAnnualMaxCapacityInvestment**
2. In Column F, filter out for Renewable Technologies: **PWRHYD, PWRSOL, PWRWND and PWRGEO**. As you might have noticed, in this exercise we are not considering PWRBIO and PWRNUC in the Renewables group.
3. Change the constraints from the Default value of 999999 to **0 from 2015 to 2070**.

	A	C	K	L	M	N	O	P	Q
1	Parameter	TECHNOLOGY	2015	2016	2017	2018	2019	2020	2021
47036	TotalAnnualMaxCapacityInvestment	PRWHYD	0	0	0	0	0	0	0
47038	TotalAnnualMaxCapacityInvestment	PWRGEO	0	0	0	0	0	0	0
47042	TotalAnnualMaxCapacityInvestment	PWRSOL	0	0	0	0	0	0	0
47044	TotalAnnualMaxCapacityInvestment	PWRWND	0	0	0	0	0	0	0

4. Save the Excel file as **Scenario_FossilFuture_v1.** You need to create a separate file (and folders) for each of the three scenarios.

Name
Fossil_Future
Least Cost
Net Zero
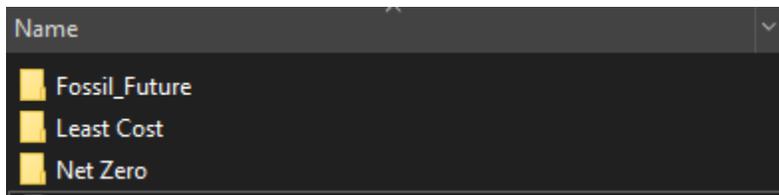
Least Cost Scenario

This scenario will reflect the optimal configuration of the energy system under which the cost is minimized. As OSeMOSYS is itself a cost-optimization model, **no additional constraints** are necessary to reach this objective. The results from the Least Cost scenario will therefore be the same as obtained in Hands-on 9.

Net Zero Scenario

The aim of this last scenario is to understand what would happen, from an environmental and economic perspective, if we commit to reach net zero Carbon Dioxide emissions by 2050. To do so in this exercise, we will use the OSeMOSYS parameter **AnnualEmissionLimit,** and we will set that to zero from 2050 until 2070.

As explained in Lecture 11, there are other constraints and parameters that can be used to model emissions reduction or climate targets that we will not use in this simplified exercise.

Try it: add a constraint on Carbon Dioxide emissions from 2050

1. Go to Parameters -> in column A filter out for the parameter AnnualEmissionLimit
2. In column D filter out for **EMICO2** (Carbon Dioxide Emissions).
3. Change the default value (999999) to **0 from 2050 to 2070**. In this way, the model will find a combination of technologies able to supply the demand that do not emit carbon dioxide.

Food for thoughts: in this exercise we are only modelling CO2 emissions. However, in SAND is also possible to model emissions of **Methane, Fluorinated Gases and Nitrous Oxides**.

Run and check results

- ## Net Zero Scenario

An example results graph from the Net Zero Scenario is shown here below. You can see that from 2050 onwards, only renewable technologies generate electricity.