Introduction to CLEWs

Hands-on lecture 4: Technology parameters

V2.0

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Disclaimer: These worksheets have been adapted from work kindly provided by the United Nations Department of Economic and Social Affairs (UNDESA) and KTH Royal Institute of Technology.

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Tags: CLEWs; Climate; Land; Energy; Water; Systems Modelling; Integrated; Policy Coherence; Installation; Hands-on; Climate Compatible Growth; Open Source; Teaching Kit.

Useful links:

1) Energy Modelling Community (EMC) Discourse Forum – please use this for any CLEWs-related discussions, especially troubleshooting queries!
2) EMC LinkedIn.
3) CCG YouTube.
4) Hands-on Solutions can be found here.

Pre-requisites:

1) Successful completion of Hands-on Lecture 3.

Learning outcomes

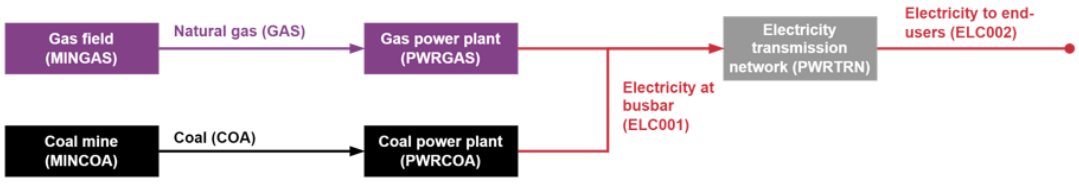
By the end of this exercise, you will be able to:

1) Define key techno-economic parameters playing a role in the analysis of an energy system
2) Use several techno-economic parameters in an energy system model
3) Understand the role of techno-economic parameters of various technologies in the least-cost planning of the energy system

Activity 1 – Introduce technoeconomic parameters

Before starting this activity, we strongly suggest you copy the model you worked on in the previous exercise. In this way, if something goes wrong with this exercise, you can go back to the model you worked on before. We recommend you do this **before any exercise where you introduce new elements in the model**. We will be reminding you to copy your model through all hands-on sessions.

Having learned about the main techno-economic parameters linked to technologies, you will now introduce them into the model you initiated in hands-on exercise 3. The structure of the model will not change this time: you will work with the technologies and commodities you defined in HO3 and will not add more, yet. You will only introduce numerical values for the parameters related to them. Below is a brief description of the parameters you will use.



Energy resources

e.g., Costs of extracting fuels, reserves (extraction limit), extraction capacity

Power Plants

e.g., operating hours/year, investment and operating costs, efficiency, lifetime

Transmission network

e.g., investment and operating costs, transmission losses

Techno-economic data refers to performance and costs data that characterise the investment in and operation of the technologies.

1. Enter data for the parameters listed in the table below by clicking on “Data Entry” in the left-hand side menu and enter the respective parameter names in the “search field” to navigate to the appropriate input tables.

   You need to enter the data for all years of the modelling period, i.e., 2020-2035, except for the “Operational Life”, “Capacity To Activity Unit”, and “Discount Rate” (**for which you only enter one value, valid for the whole modelling period**).

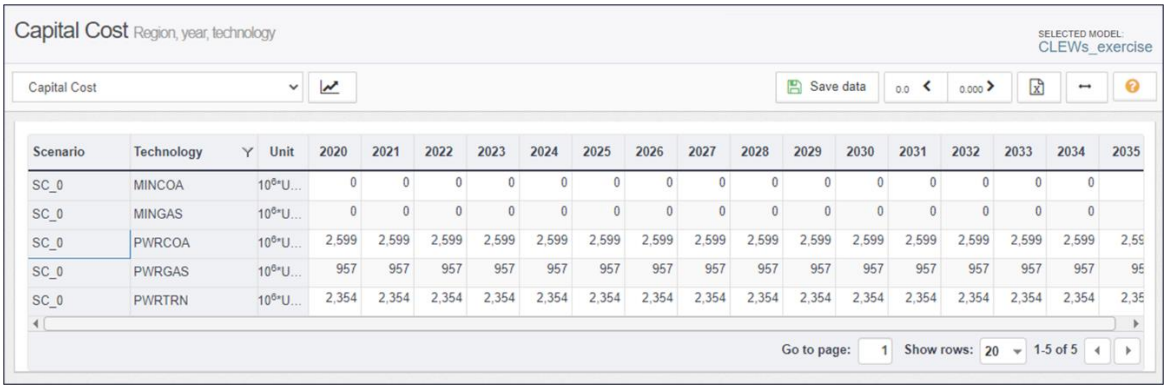
Parameter	Units	MINCOA	MINGAS	PWRCOA	PWRGAS	PWRTRN
Availability Factor	Fraction	1*	1*	1*	1*	1*
Capital Cost	M$/GW ($/kW)	0.0001*	0.0001*	2599	957	2354
Fixed Cost	M$/GW ($/kW)	0.0001*	0.0001*	72	27	24
Variable Cost	M$/PJ ($/GJ)	1.52	6.00	2.2	0.5	0.0001*
Operational Life	Years	30	30	30	30	50

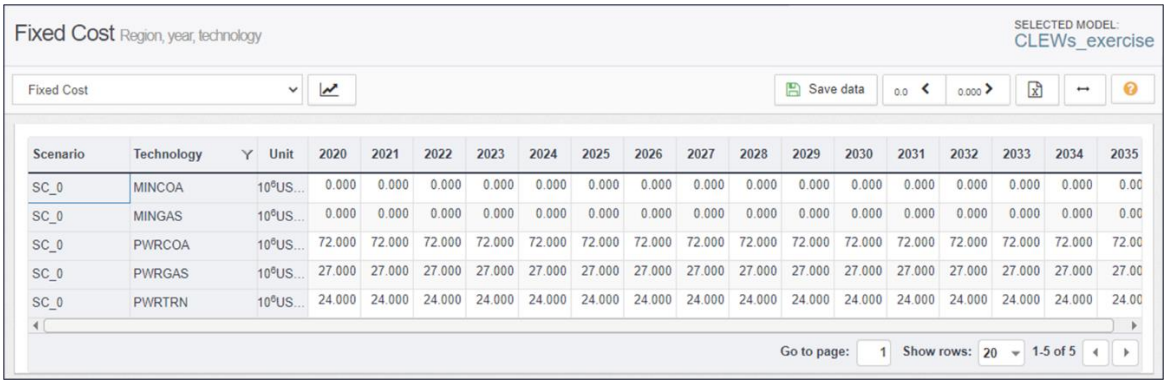
Discount Rate	5% *

** Default value*

You can also find the above data available in the Excel sheet, that you should have already downloaded!

Below is how the tables of the various parameters listed in the table above should look like, after you have introduced the values.





Fixed Cost Region, year, technology

SELECTED MODEL: CLEWs_exercise

Fixed Cost | Save data

Scenario	Technology	Unit	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
SC_0	MINCOA	10⁶US...	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
SC_0	MINGAS	10⁶US...	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
SC_0	PWRCOA	10⁶US...	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.00
SC_0	PWRGAS	10⁶US...	27.000	27.000	27.000	27.000	27.000	27.000	27.000	27.000	27.000	27.000	27.000	27.000	27.000	27.000	27.000	27.00
SC_0	PWRTRN	10⁶US...	24.000	24.000	24.000	24.000	24.000	24.000	24.000	24.000	24.000	24.000	24.000	24.000	24.000	24.000	24.000	24.00

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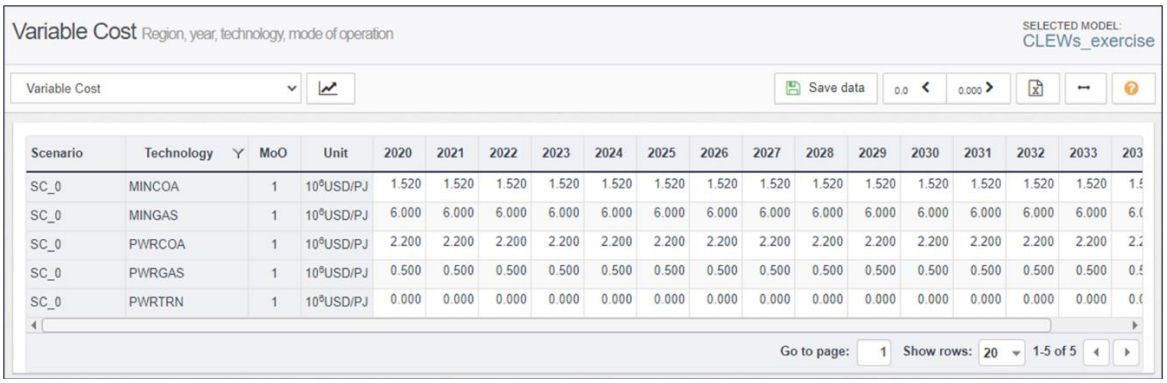

Variable Cost Region, year, technology, mode of operation

SELECTED MODEL: CLEWs_exercise

Variable Cost | Save data

Scenario	Technology	MoO	Unit	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	203
SC_0	MINCOA	1	10⁶USD/PJ	1.520	1.520	1.520	1.520	1.520	1.520	1.520	1.520	1.520	1.520	1.520	1.520	1.520	1.520	1.5
SC_0	MINGAS	1	10⁶USD/PJ	6.000	6.000	6.000	6.000	6.000	6.000	6.000	6.000	6.000	6.000	6.000	6.000	6.000	6.000	6.0
SC_0	PWRCOA	1	10⁶USD/PJ	2.200	2.200	2.200	2.200	2.200	2.200	2.200	2.200	2.200	2.200	2.200	2.200	2.200	2.200	2.2
SC_0	PWRGAS	1	10⁶USD/PJ	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.5
SC_0	PWRTRN	1	10⁶USD/PJ	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0

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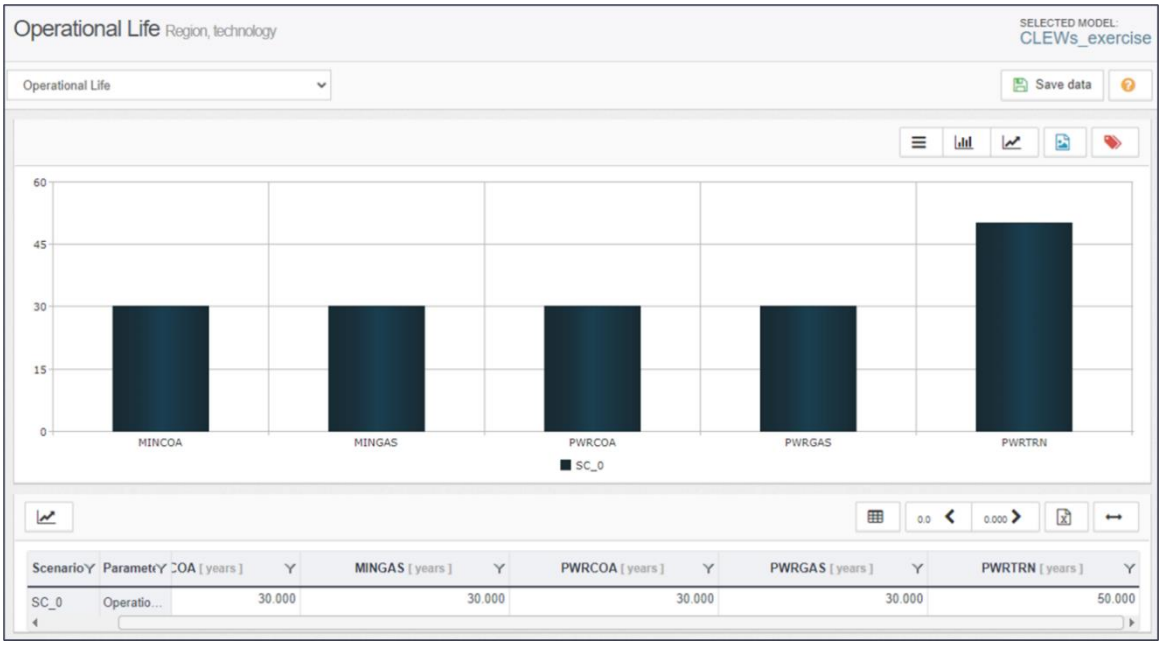

Operational Life Region, technology

SELECTED MODEL: CLEWs_exercise

Operational Life | Save data

Scenario	Parameter	COA [years]	MINGAS [years]	PWRCOA [years]	PWRGAS [years]	PWRTRN [years]
SC_0	Operatio...	30.000	30.000	30.000	30.000	50.000

NOW RUN THE MODEL:

2. Create new case and name it as “HO4_A1” and write a similar description to what you did before. Once the case is created and is listed under “Cases”, select the case by clicking on it and then click on “Data File” in the “Case Data” window. This will compile the data file to be run.
3. Run the model clicking on “RUN MODEL”.
4. Go to the “Results” view and visualise results for “Production by Technology by Mode”. Since now we have two cases (HO3_A1 and HO4_A1) in the default setting, results view should be displayed side-by-side to compare the two cases.
5. Visualize results for power plants only (i.e., PWRCOA and PWRGAS), you can do this using the saved view created in the previous exercise. As a reminder, follow these steps:

a) You will first land on accumulated new capacity, change the graph to **Production by Technology by Mode.**
b) You will know see the two different runs next to each other.
c) You need to set some filters in the **pivot table**. **Untick Commodity** and **tick Tech Description**. Add tech description to **column**.
d) Right click on tech description and go to **field settings**, then only select the coal and gas power plant.
e) You should now see the difference between energy production between Hands-on 3 and Hands-on 4!

Note: Please be advised to always back up your model.

To back up a model, go to the Home screen and click on the download icon to the right of its name. This will download the model itself, as a zipped folder. **Do not unzip the folder and do not change its name**. Store it safely in a place of your choice.