

Energy System Modelling Using OSeMOSYS

Hands-on 10

Please use the following citation for:

- **This exercise**

Plazas-Niño, F., Kiley, F. (2025, February). Hands-on 10: Energy System Modelling Using OSeMOSYS (Version 1.0.). Climate Compatible Growth. DOI: 10.5281/zenodo.14871470

- **OSeMOSYS UI software**

Climate Compatible Growth. (2024). MUIO (Version v5.0.0). GitHub.
<https://github.com/OSeMOSYS/MUIO/releases>

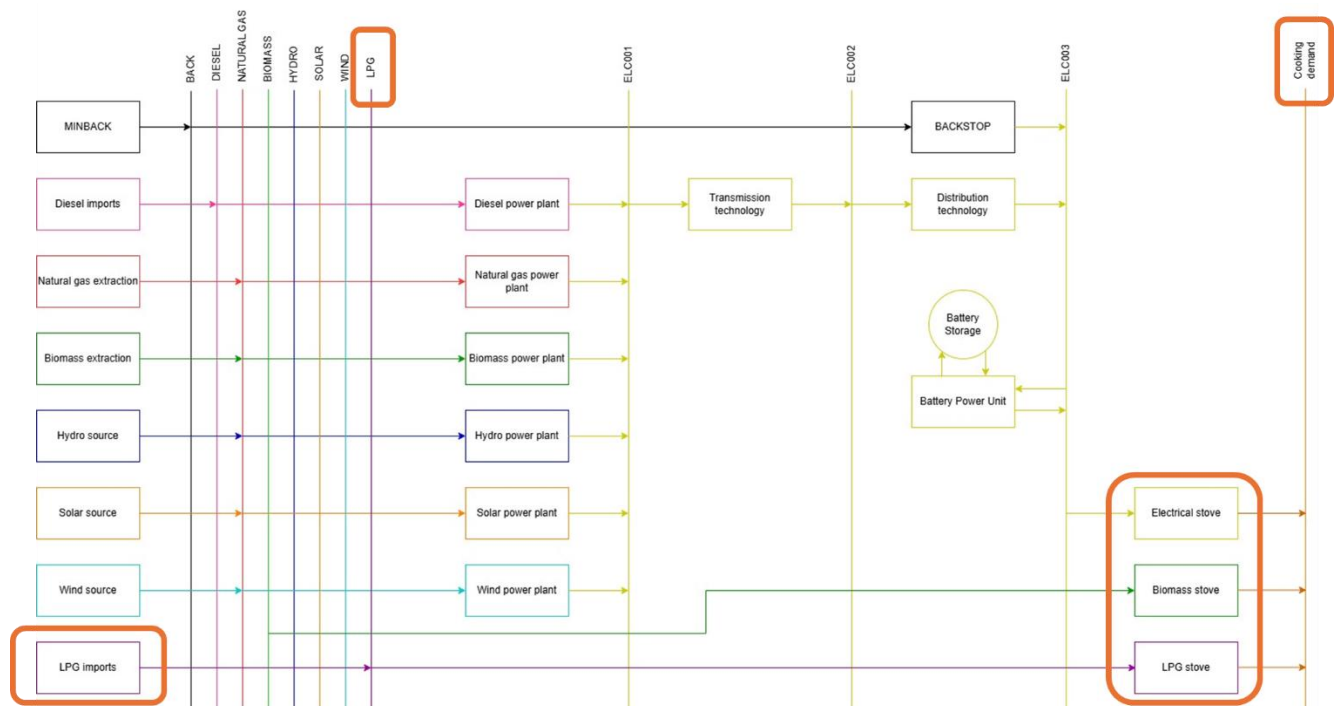
Learning outcomes

By the end of this exercise, you will be able to represent the following in OSeMOSYS:

- 1) An energy demand in the residential sector
- 2) A set of technologies to supply an energy demand in the residential sector

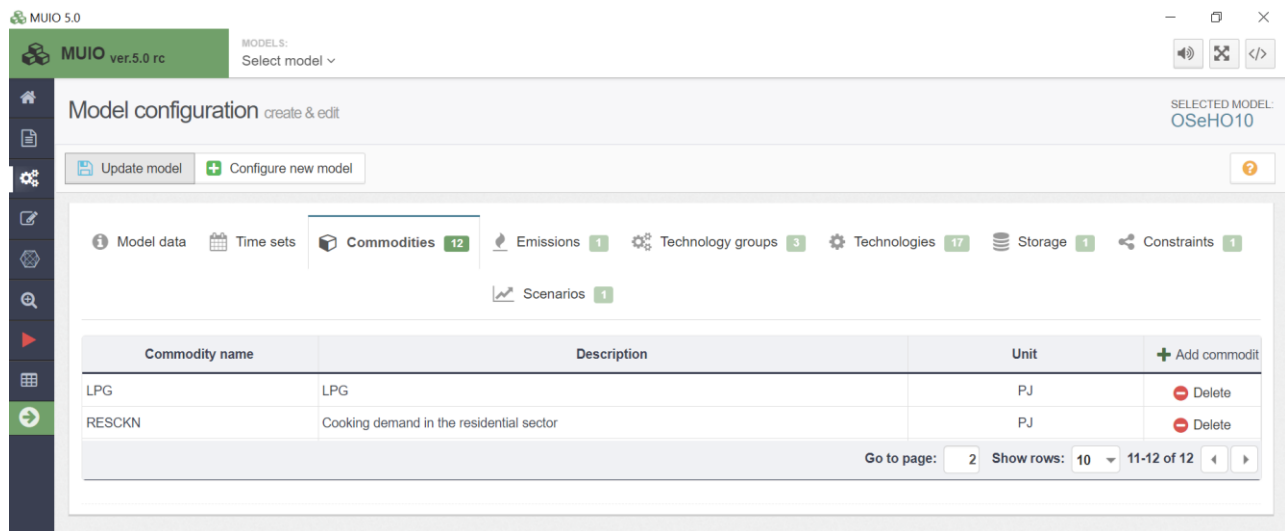
Add a New Energy Demand

In this hands-on, we will add four technologies in total: three end-use technologies to represent stove alternatives with biomass, liquefied petroleum gas (LPG), and electricity (DEMRESCKNBIO, DEMRESCKNLPG, and DEMRESCKNELC, respectively), and one primary supply technology to represent the imports of LPG (IMPLPG). Two new fuels (commodities) will be added to the model: LPG and RESCKN (cooking demand in the residential sector). We will build the highlighted parts of the RES below. **Note:** Update your RES in diagrams.net.



IMPORTANT: Before you can do anything else, you must copy the model and rename it in the same way you have before (OSeHO10 this time).

We will start by creating two new commodities: LPG and RESCKN. The unit for both is PJ.



Next, we need to add the data for the useful energy demand of RESCKN. This time, we will use the parameter 'Accumulated Annual Demand' to specify the annual demand.

Try It: Add the demand for the cooking service (RESCKN)

1. Click on the data entry button, and in the search bar, type '**Accumulated Annual Demand.**' Then, navigate to that parameter.
2. Locate RESCKN in the parameter list. Copy and paste the demand data for the years 2021–2035 from the [Data Preparation file OSeHO10](#).
3. The input should resemble the image shown below.

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MODELS: Select model

Accumulated Annual Demand Region, year, commodity

SELECTED MODEL: OSeHO10

Accumulated Annual Demand

Save data

0.0 0.000

Scenario	Commodity	Unit	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
SC_0	BACK	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	0.000
SC_0	ELC003	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	0.000
SC_0	NGS	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	0.000
SC_0	DSL	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	0.000
SC_0	ELC001	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	0.000
SC_0	ELC002	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	0.000
SC_0	HYD	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	0.000
SC_0	BIO	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	0.000
SC_0	SOL	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	0.000
SC_0	WND	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	0.000
SC_0	LPG	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	0.000
SC_0	RESCKN	PJ	4.200	4.300	4.400	4.500	4.600	4.700	4.800	4.900	5.000	5.100	5.200	5.300	5.400	5.500	5.600

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Note: Make sure to save the data and update the model each time you complete this process.

Add New Technologies

We will add the new technologies using the same steps covered in hands-on exercises 5 and 6.

Try it: Add 4 new technologies using the [Data Preparation File OSeHO10](#).

1. **IMPLPG** – LPG imports
2. **DEMRESCKNLPG** – LPG stove in the residential sector
3. **DEMRESCKNBIO** – Biomass stove in the residential sector
4. **DEMRESCKNELC** – Electrical stove in the residential sector

Repeat the same steps shown for Primary Supply Technology and Power Plants in **Hands-on 6**. *Don't forget to add the emission activity ratio for the LPG stove. The new technologies should look like the image below.*

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MODELS: Select model

Model data Time sets Commodities 12 Emissions 1 Technology groups 3 Technologies 21 Storage 1 Constraints 1 Scenarios 1

Technology	Description	Technolo...	Unit of ca...	Unit of ac...	Input Activity R...	Output Activity ...	Input To New C...	Input To Total C...	Emission Activi...	+ Add technol
PWRHYD	Hydropower plant		GW	PJ	HYD	ELC001				Delete
PWRBIO	Biomass power ...		GW	PJ	BIO	ELC001				Delete
MINSOL	Solar source		PJ	PJ		SOL				Delete
MINWND	Wind source		PJ	PJ		WND				Delete
PWRSOL	Solar power plant		GW	PJ	SOL	ELC001				Delete
PWRWND	Wind power plant		GW	PJ	WND	ELC001				Delete
BATTPWR	Battery Power		GW	PJ	ELC003	ELC003				Delete
IMPLPG	LPG imports		PJ	PJ		LPG				Delete
DEMRESCKNLPG	LPG stove		GW	PJ	LPG	RESCKN			CO2	Delete
DEMRESCKNBIO	Biomass stove		GW	PJ	BIO	RESCKN				Delete

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MODELS: Select model

Model configuration create & edit

Update model Configure new model

Model data Time sets Commodities 12 Emissions 1 Technology groups 3 Technologies 21 Storage 1 Constraints 1 Scenarios 1

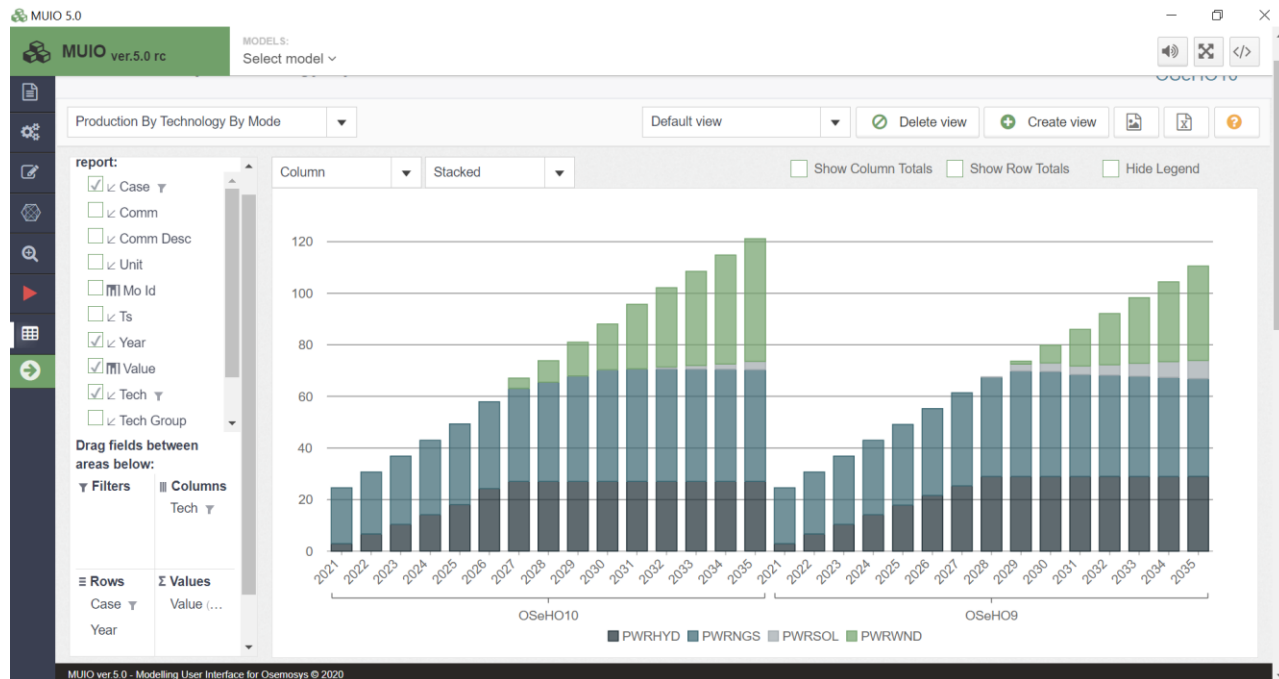
Technology	Description	Technolo...	Unit of ca...	Unit of act...	Input Activity R...	Output Activity ...	Input To New C...	Input To Total C...	Emission Activi...	+ Add technol
DEMRESCKNELC	Electrical stove		GW	PJ	ELC003	RESCKN				Delete

Go to page: 3 Show rows: 10 21-21 of 21

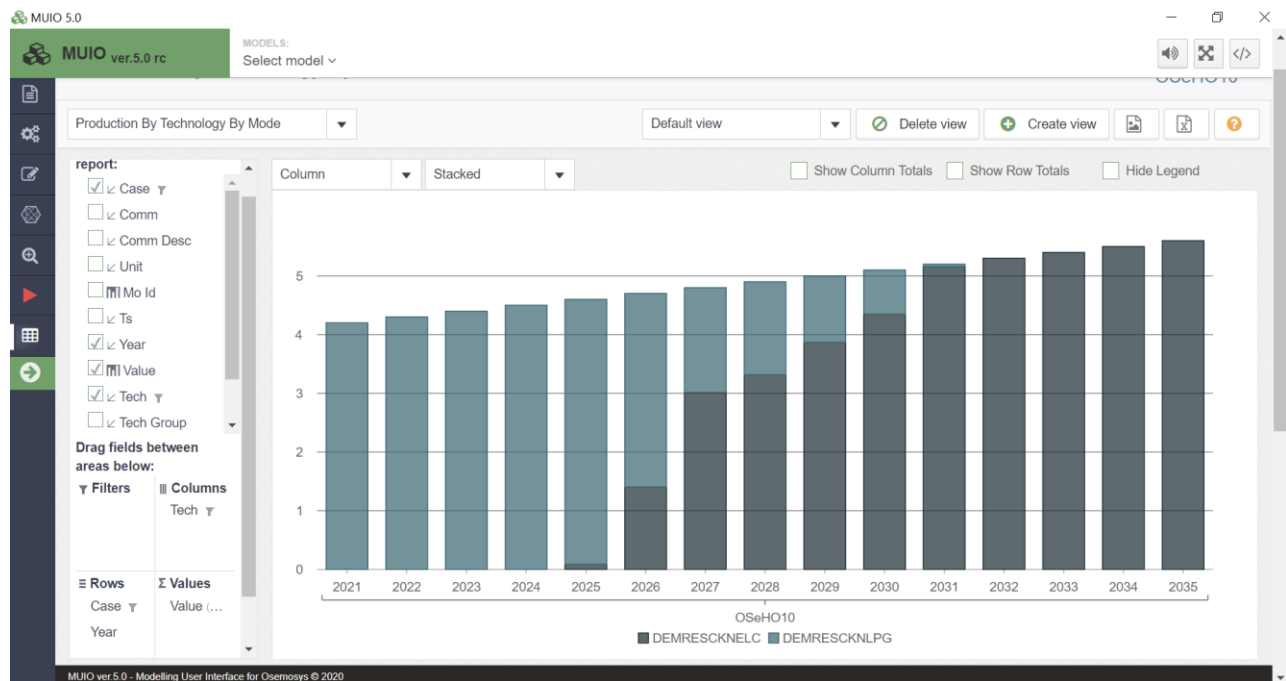
SELECTED MODEL: OSeHO10

Run the model and check the results

Run the model in the user interface as demonstrated in previous exercises. Since we now have two energy demands, we need to be mindful of how we plot the results for Production by Technology by Mode (PJ). First, filter for the power plants, as done previously, and compare the results between HO9 and HO10. The graph should resemble the image shown below.



In this exercise, the system produces more electricity to meet the demand for electrical stoves. If we change the filter to select the stove technologies, we will see that DEMRESCKNELC increasingly supply cooking demand from 2025. This indicates that electrification becomes more cost-effective than relying on the residual capacities of LPG or biomass stoves. The underlying reason is that the variable costs of importing LPG or producing biomass are higher than the combined investment costs for electrical stoves and generating additional electricity. We will calibrate these results in hands-on 13.



Question to consider: If electrical stoves were not available, which technology do you think would become the main cooking service supplier? How can we model this situation?