Introduction to the Climate-Land-Energy-Water (CLEWs) modelling framework and its use in the Nexus Assessment of the Drin River Basin

Day 2 – July 7th, 2021

Agenda

Time	Session	Presenter
9:30-9:45	Welcome and recap of Day 1	Francesco Gardumi
9:45-10:45	Follow-along exercise: creating a simple model	Francesco Gardumi
10:45-11:00	Break	
11:00-11:45	Follow-along exercise: creating scenarios	Francesco Gardumi
11:45-12:30	Github and Drin model transfer	Youssef Almulla
12:30-12:45	Wrap-up and end of session	Youssef Almulla

Recap of Day 1

- Acquired general knowledge about the assessment of the water-energy-food nexus
- Understood the scope and characteristics of the CLEWs nexus methodology
- Understood the methodology underlying the water-energy model of the Drin River Basin
- Related the scenario results of the water-energy model of the Drin river basin to key numerical assumptions and to the methodology

Questions?

Day 2 – July 7th, 2021

Learning objectives

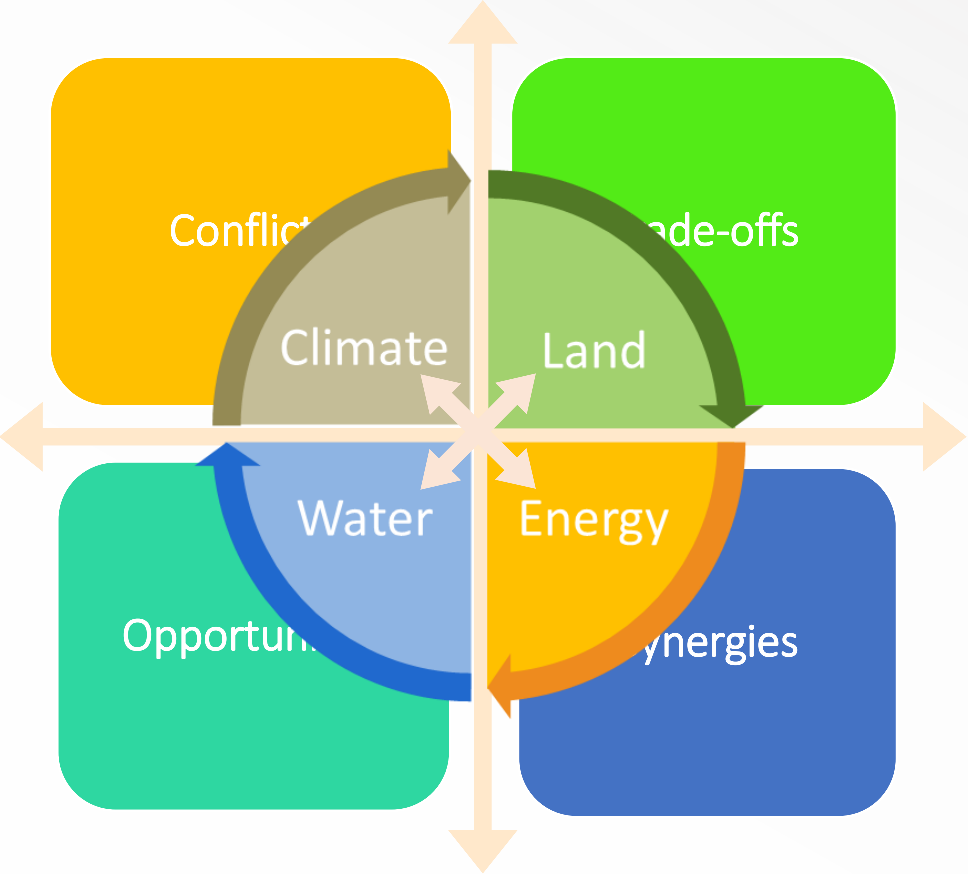
- Understand the key elements of a long-term water-energy model
- Create and modify a simple long-term energy system model
- Understand how to run the Drin water-energy model

Session I Follow-along exercise: creating a simple model

What we saw yesterday

The CLEWs framework suggests the linkages can be quantified:

- developing an integrated accounting model (resources use factors, adding CLEWs elements to sectoral models);
- with the development of sectoral systems models and integration and iteration between these;
- using a single model framework (e.g. OSeMOSYS).



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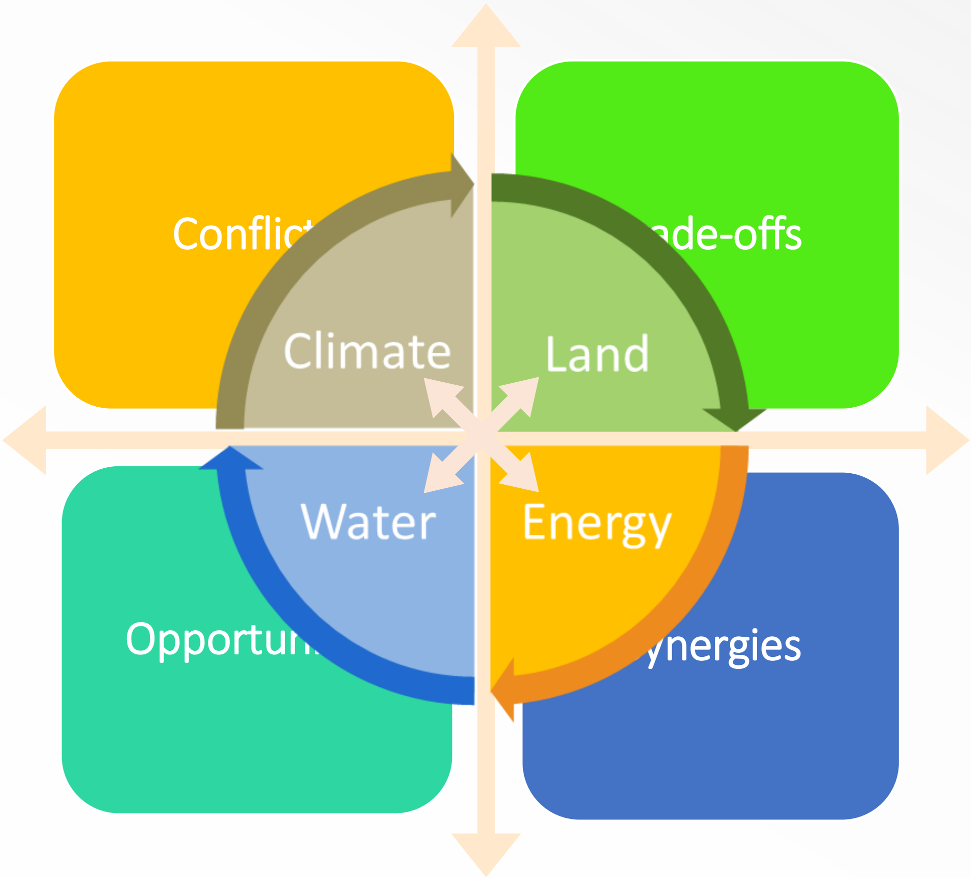

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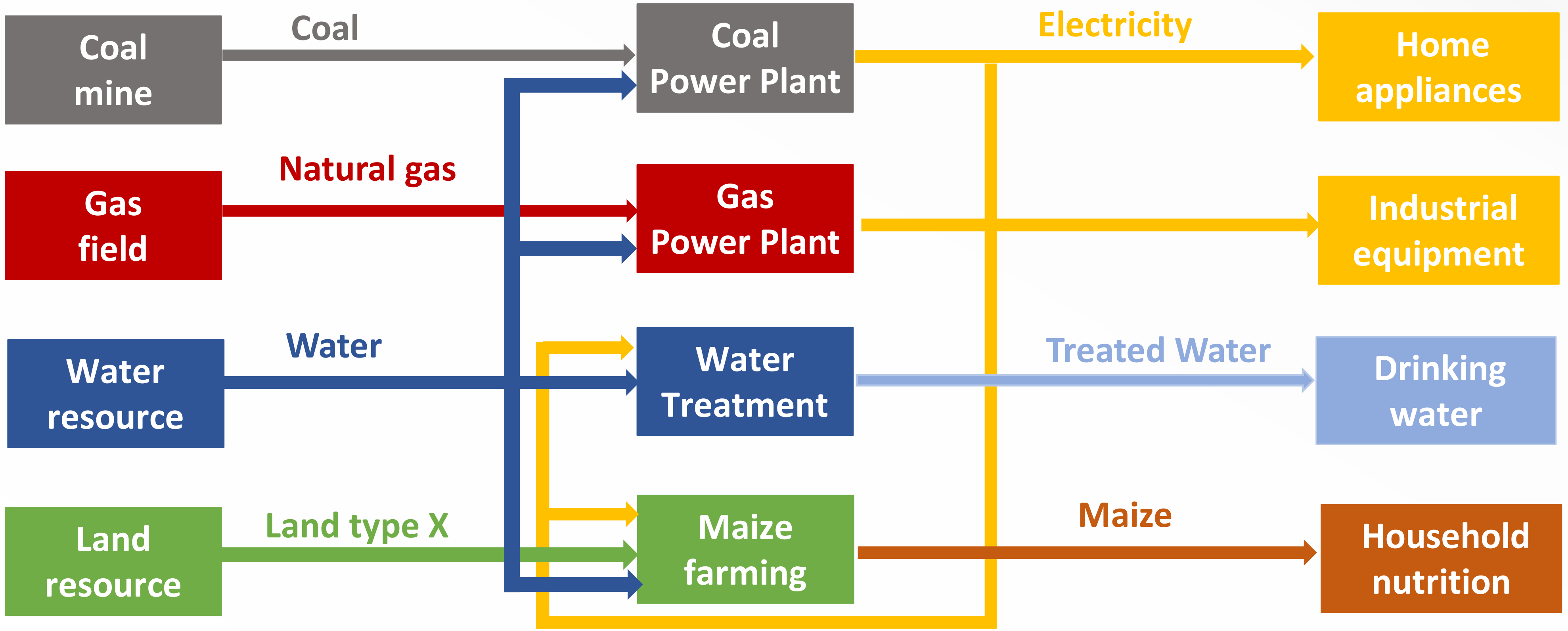


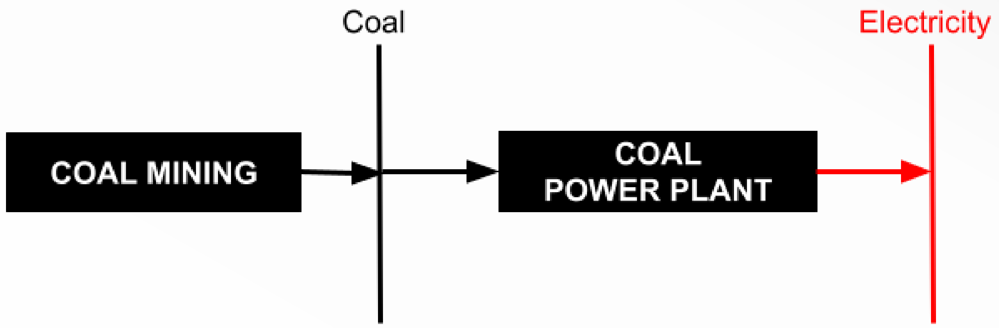
A very simple model to start with

1 simple chain:

1 demand and 1 supply option

The supply must meet the demand

We will work on a **.txt file**



What does an OSeMOSYS model do?

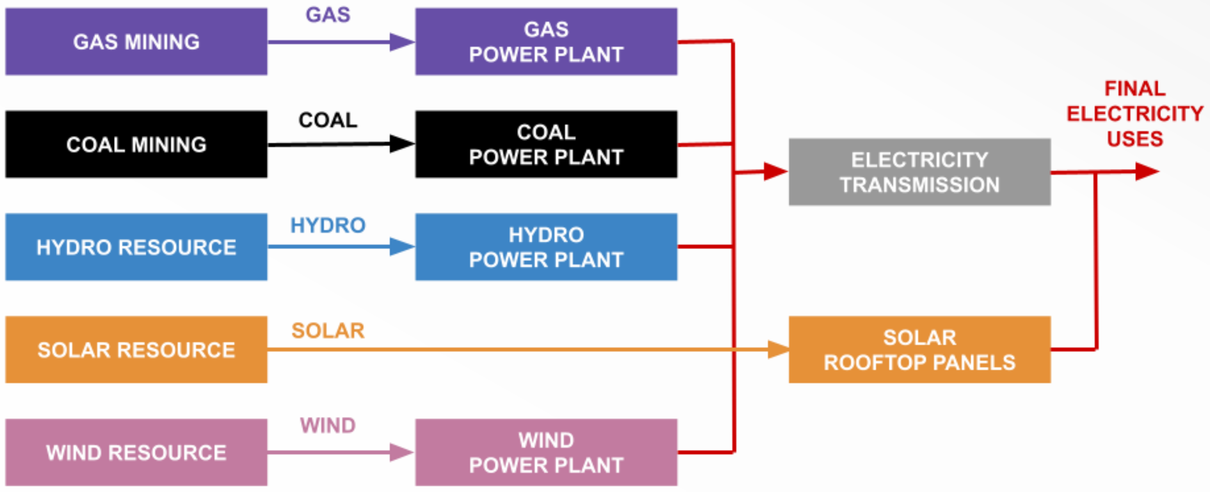
A simplified representation of reality

Technologies (boxes) and commodities (lines)

This type of model answers:

- What technology to invest in
- When to invest
- How much to invest
- How to operate the system

Structure of a simple sample electricity system model

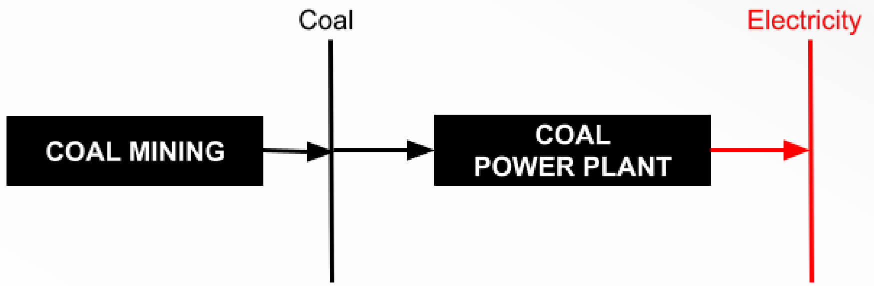


Structure of the model

To create the model, we need the following sets of information:

- Technologies
- Fuels
- Years over which we'll model
- The sub-annual time-slices that will be considered

Hint: ALWAYS sketch out a schematic representation (also called **Reference Energy System**)



Technology

- DEMPWRCOA – Coal import
- PWRCOA – Coal power plant

Fuels

- COA – Coal
- ELC002 - Electricity

Year

- 2019-2022

Time slices

- Day & Night

Key concepts: Time and Demand

We assume an electricity demand of 100 PJ in 2019, then growing by 25 PJ every year

More energy is normally required during the day, so we assume that:

- **2/3** of the electricity is used during the day
- **1/3** of the electricity is used during the night

We split the year equally into Day and Night:

- Day takes **50%** of the time in one year
- Night takes **50%** of the time in one year

Key concepts: Time and Demand

We assume an electricity demand of 100 PJ in 2019, then growing by 25 PJ every year (Associated parameter: Specified Annual Demand)

More energy is normally required during the day, so we assume that: (Associated parameter: Specified Demand Profile)

- **2/3** of the electricity is used during the day
- **1/3** of the electricity is used during the night

We split the year equally into Day and Night: (Associated parameter: Year Split)

- Day takes **50%** of the time in one year
- Night takes **50%** of the time in one year

Key concepts: Technology activity, capacity, input and output

Capacity: installed power (max energy generated per unit of time)

Activity: total actual operation

Output-to-activity ratio: output produced per unit of activity (we assume that 1 unit of electricity is produced for every unit of activity of the power plant**)

Input-to-activity-ratio: input needed per unit of activity. Depends on the efficiency

Capacity-to-activity-ratio: fixed conversion between capacity and activity units. Max energy provided by one unit of capacity in one year. It depends on the chosen units.

Setting up a model

1. If you get stuck, check out the user guide and the online forum
2. Always draw a Reference Energy System scheme
3. Chose the code required
4. Put in the Set data
5. Put in the Parameter data
6. Check all constraints and 'default valules'
7. Start with a demand
8. Introduce the Backstop
9. Build the model progressively

Let us get to work

You will be able to start the exercise by opening the link below:

https://mybinder.org/v2/gh/KTH-dESA/UNECE-Capacity-Building/main?filepath=cb_simple_example.ipynb

Session II Follow-along exercise: creating scenarios

Let us get to work

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