

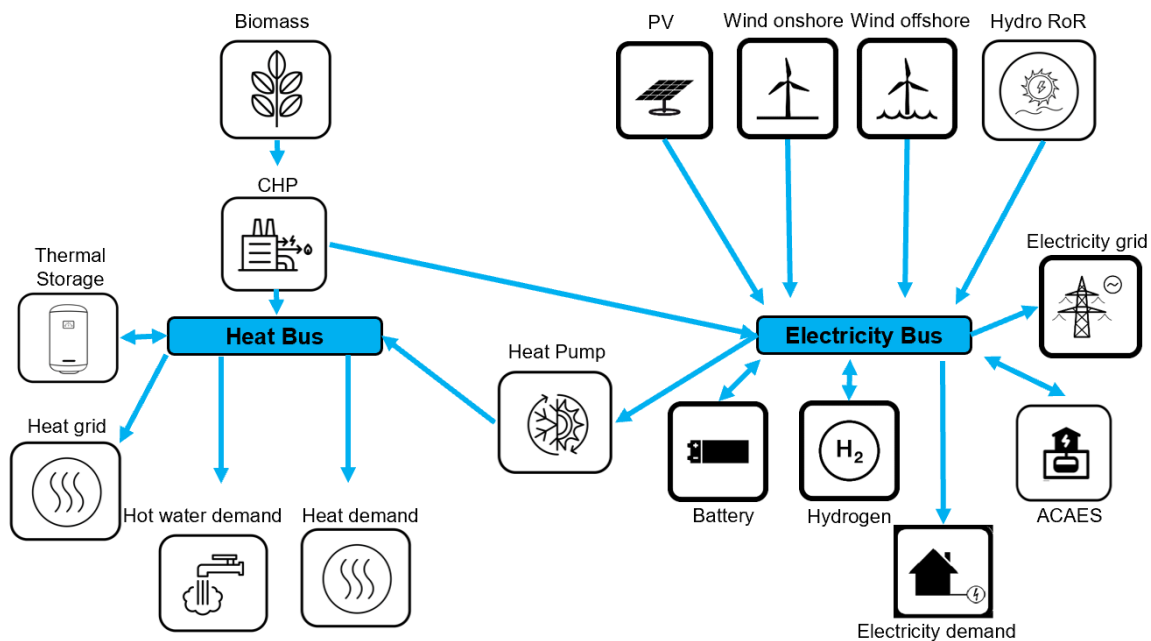
# Homework - Energy System 2

Technische Universität Berlin

Chair for Energy Process Engineering and Conversion Technologies for Renewable Energies

Module: Sustainable energy supply in on- and off-grid systems

The purpose of this homework is a further analysis of the 100% renewable-based energy system model of Schleswig-Holstein with the Python library *oemof*. For the first part a biomass resource availability of 3.034 TWh (50% of total biomass availability 6.069 TWh) shall be used. The following figure 1 represents the energy system model.



**Figure 1:** Representation of the energy system, which shall be modeled.

For this homework use the finalized energy system model files from the Exercise Energy System 2, provided on Isis. Save all numeric results in a excel file in the results folder, use for this purpose the in Exercise Energy System 2 proposed `pandas.ExcelWriter()`.

## 1 Exercise

Model analysis based on 50% biomass availability.

- Extract optimized capacity investments (this is the installed power/capacity) of all technologies. Explain the capacity investment results and the connection to the met assumptions in *input data exercise2.xls* (folder data). Examine and explain the effect of two basic parameter changes on the optimized capacity investment results.
- Extract and calculate the capacity costs (capex and fom) of all optimized component investments. (Hint: results cannot be extracted from the energy system model directly, needs to be calculated with exogenous and endogenous variables).
- Extract and calculate the optimized total energy mix for the electricity sector and the heat sector. Calculate total energy of each component in the corresponding sector, transfer all units to TWh.
- Calculate the hourly and mean annual State of Charge of all storage technologies. Explain differences in SoC profiles, is the difference between short- and long-term storage sufficiently modeled? Which parameter could improve model accuracy in this regard?

## 2 Exercise

Model analysis of biomass availability. How does the results on capacity investment change dependent on the biomass resource availability, model the case of 25% biomass availability (1.52 TWh) and compare it with 100% biomass availability (6.07 TWh).

- Explain the changes in capacity investments
- Explain changes regarding used storage technologies

## 3 Exercise

Model evaluation in the context of the representation for a 100% renewable-based energy system of Schleswig-Holstein. Is the energy system model a realistic representation of the real system?

- Which assumptions in the energy system model are the most relevant and affect the results the most?
- Which technologies or resources are not considered in the model and how much affects this the results?

***The homework needs to be handed-in in form of a zip file, containing the folders data with the input data excel file, the folder results with a excel file containing all requested numerical results from question 1 and the folder src with the Spyder/Jupyter source code file. Answers to questions 1, 2 and 3 shall be handed-in as written text in any common textfile format (e.g. Word).***