Homework 1

Task 1 Marginal Costs:
The marginal costs for electricity generation normally consists of the following components: Fuel costs, CO2 costs and operation/maintenance costs.

Additionally, the power plant's efficiency η and specific emission factor λ are necessary to bring those parts together in the resulting costs. Thus, the marginal costs for each power plant/technology is calculated as:

$$mc_p = \frac{\text{fuel\_costs}_p}{\eta_p} + \text{co2\_costs} \cdot \lambda_p + \text{om}_p$$

Table 1: Data

technology s	Fuel cost	η	O&M	λ
Nuclear	3.00	0.33	10	0
Lignite	6.21	0.42	6	0.399
Hard coal	10.60	0.42	6	0.337
Natural gas	31.08	0.59	2	0.201

Implement this cost calculation in the provided template.

Task 2 Storages:
Start- and Endconditions are critical when considering storages in the model. Implmenent and compare three different assumptions with respect to the storage use and overall model behavior:

- Set the storage level to 50% in the first time step
- Set the storage level to 50% in the first and last time step
- Force the start- and endlevel to be equal, without specifying a value

Describe and **explain** the differences in a few sentences.

Task 3 Renewables:
In the lecture we discussed curtailment of renewables and how this can be implemented in a model. Do this for the res&storages model from the lecture.

Use the existing time series as an availability parameter and use a new variable G^{res} to allow for curtailment.

$$G^{res}_{r,t} \leq g^{max}_r \cdot ava_{r,t} \qquad \forall r \in R, t \in T$$
$$G^{res}_{r,t} \geq g^{max}_r \cdot ava_{r,t} \cdot 0.9 \qquad \forall r \in R, t \in T$$

For the maximum genertion parameter of the renewables use the following data:

Run and compare different scenarios in terms of dispatch and objective value:

- No curtailment and storages
- Curtailment, but no storages
- Curtailment and storages

Describe your results

Please send your results to riw@wip.tu-berlin.de until May 14th 2018