# DENSYS SCHOOL

## ASSIGNMENT: SIZING A MICROGRID

Author: Bertrand Cornélusse -- date: 2021-06-04

**Problem definition**

You are asked to size a household microgrid (actually, the microgrid you could set up in your house). A time series of load data is provided (`sizing.csv`), together with the yield (per Wp) of a PV installation according to the orientation of the house's roof. The grid connection is single-phase and can be either 16A, 32A or 64A, with a nominal voltage of 230V. You can alternatively invest in a genset to disconnect from the public grid. There are three genset sizes available (see the file `paramaters.py` that details all parameters and the nominal values you should use). As a base case, the energy sent back to the grid is not valued, and there is no net metering (energy produced is not subtracted from energy taken from the grid). You can buy battery packs where the energy capacity can be sized independently of the inverter power. In a similar way, PV capacity can be sized independently of the PV inverter power.

**Tasks**

1. Explore and describe the input data (the load and the PV series, essentially)
2. Solve this problem using a mixed-integer programming formulation. You can assume you have full knowledge of the future, i.e. all the data is known from day one.
    a. In practice we have already coded a part of the model (see in `microgrid_sizing_opt.zip`), and your first task is to complete it, mainly the file `sizing_opt_template.py`
    b. Use the same python distribution and solver as for the operational planning exercise.
3. Report the results obtained, the computation time, and the value of the objective over the investment horizon (20 years) for the following cases:
    a. Make the number of days simulated vary (e.g. from 30 to 365)
    b. Make the start date vary to cover the provided data
4. Assuming all parameters are fixed to their original value
    a. Let the grid import price vary. What is the value of the grid import price above which the microgrid disconnects from the main grid?
    b. Let the PV capacity price vary. What is the value of the PV capacity price above which there is no interest in investing in PV?
5. Export remuneration mechanism (repeat step 2 for a new model as described below):
    a. Compute the optimal sizing in case the energy sent back to the grid is valued at 0.06 [EUR/kWh]
    b. Compute the optimal sizing in case of net metering

Report your results in a (short) document and a zip of the code by email to bertrand.cornelusse@uliege.be .