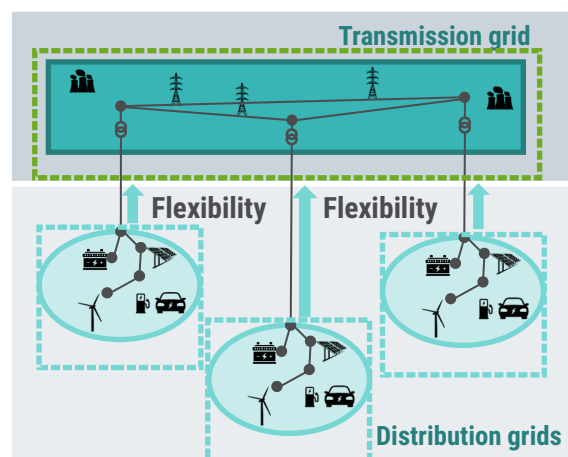


## Oberseminar on “Aggregation of Flexibilities for Energy Systems”

Energy systems are often composed of many subsystems, where an “upper-level” energy grid interconnects several “lower-level”-grids. The question arises how to operate these large-scale systems. In many cases, operation is done via numerical optimization, i.e. an optimization problem is formulated, where a goal (minimizing energy consumption, maximizing profit, ...) is encoded in the objective function and technical limitations (maximum power generation, flow limits, ...) and the underlying physical laws are formulated as constraints. For large-scale energy systems, solving these optimization problems centrally is often not feasible.

An approach to reduce complexity is via aggregation. Here, the main idea is to simplify, i.e. to “aggregate”, the lower-level grids in some form. Aggregation means that the constraints of the lower-level grids are formulated in terms of the coupling variables only. Doing so, the problem size of the upper-level problem is drastically reduced. The upper-level solver computes an optimal value for the coupling variables and the lower-level grid “disaggregates” by solving an optimization problem for fixed coupling variables.

In general, aggregation-based schemes are not optimal, i.e. one can achieve a better performance when solving the overall problem. Moreover, computing the aggregation of the lower-level problems is non-trivial and it is important to ensure feasibility, i.e. one has to ensure that the lower-level problem has a solution once the upper-level problem has decided on the coupling variable. This seminar will consider different approaches for aggregation mainly from power systems and compare their properties in terms of complexity and loss of optimality.



Registration deadline: 16.10.2022

Max. number of students: 10

Seminar hosts: Dr. Alexander Engelmann  
Maísa Beraldo Bandeira