University of Stuttgart
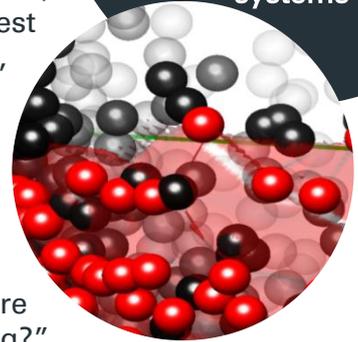Germany
Department for Stochastic Simulation
and Safety Research for Hydrosystems (LS³)

Understanding the
uncertainty
when **planning**
a combination of
energy storage
systems

B.Sc. Topic

Renewable energy sources (photovoltaic, wind, hydropower) are great, but they are very variable and uncertain. Hence, power systems need to become more flexible, a challenge in which energy storage systems (ESS) are most helpful. It is widely accepted that there is no single, ideal ESS; rather a combination of these must be found. To decide what the best combination of ESS is (also know as ESS expansion planning), optimization is frequently used. Just like any future planning, ESS expansion planning is plagued with uncertainty; and errors of the inputs and parameters have direct impacts on the results. However, most of the expansion planning studies are deterministic (i.e. they neglect all uncertainty).

In the proposed thesis, we aim to answer the questions "how certain are the recommendations found by a software for ESS expansion planning?" and "how can that uncertainty be quantified with only small computational effort?". A succesfull thesis will strongly contribute in assessing energy policies for the energy transition.

Prospective Tasks

- Run an existing program for ESS expansion planning. These deterministic results will be the base case.
- Perform Monte-Carlo simulation by varying a set of parameters that has large uncertainty. Analyse the error interval of these results and contrast them with the base case.
- Identifty a smaller subset of parameters that has the most impact on the optimization problem. Re-run the Monte-Carlo simulation, but only with this smaller subset of parameters. Compare the new error interval with the first Monte-Carlo simulation.
- Try out the method on two small case studies.

General Information

- Advisors: Jannik Haas (LS³), Felix Cebulla (DLR Stuttgart) and Prof. Wolfgang Nowak (LS³)
- Publishing the results in a journal is targeted.

Desireable skills

- If you enjoy optimization, modelling and statistics, and of course, love renewable energies, this topic is the right one for you!

Apply now!
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