



**University of Stuttgart**  
Germany

Department for Stochastic Simulation  
and Safety Research for Hydrosystems (LS<sup>3</sup>)

### **B.Sc. Topic**

Renewable energies (photovoltaic, wind, hydro) are great, but their variable and uncertainty need to be balanced. So, if we aim for large shares of renewables, we need (some) energy storage.

To decide the best combination of storage technologies, large optimization problems are formulated. As these often take (reeeeeally) long times to solve, many simplifications are made. For example, the efficiency (converting water to power) in hydropower reservoirs is frequently assumed to be constant, which leads to errors in the final investment recommendations. In the proposed thesis, different alternatives for modeling the efficiency curves are implemented and compared.

A successful thesis will lead us one step closer to answer *how can storage contribute to a 100% renewable power grid?* Publishing results in a Journal is targeted.

### **Prospective Tasks**

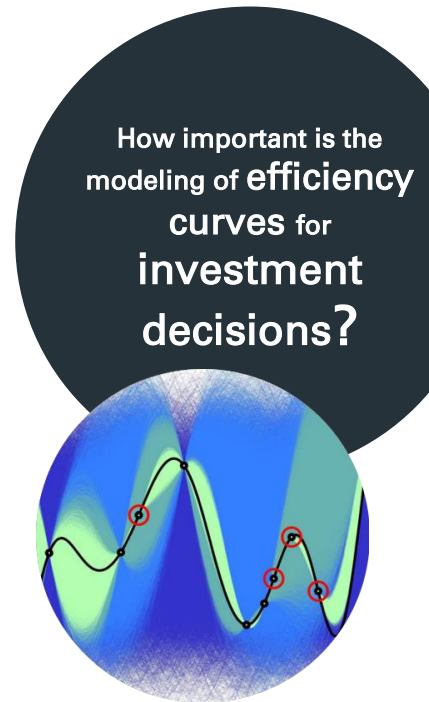
- Get familiar with the existing model for investment decisions
- Implement a piece-wise linear and a non-linear formulation for the efficiency curve
- Visualization of results and discussion

### **General Information**

- Advisors: Jannik Haas and Prof. Wolfgang Nowak
- Theoretic study based on optimization

### **Desirable skills**

If you enjoy optimization and modeling in Matlab or GAMS, and of course, love renewable energies, this topic is the right one for you!



**Apply now!**  
[jannik.haas@iws.uni-stuttgart.de](mailto:jannik.haas@iws.uni-stuttgart.de)