

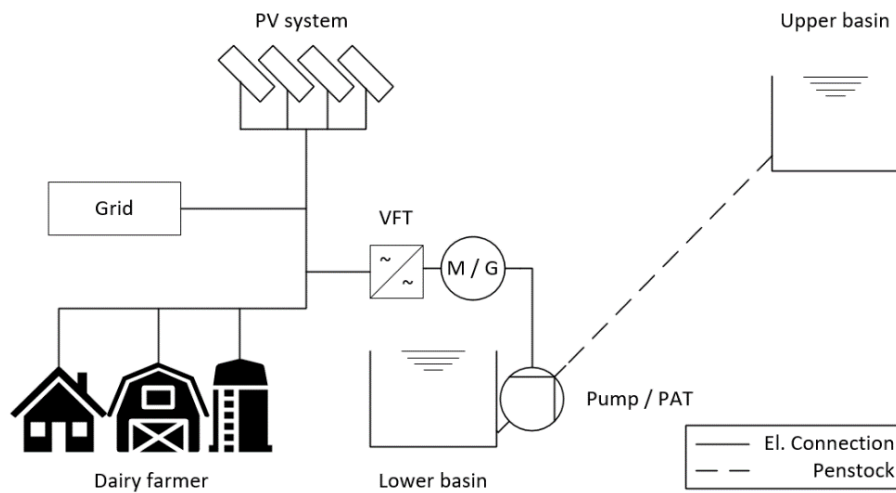
Assignment for the project work (AP - DP - PA)

Project planning of a micro pump storage system using a pump as a turbine

Motivation:

A promising application of a micro-pump storage system (MPS) is its application for self-generated electricity usage optimization in combination with an existing photovoltaic (PV) system. In pump mode, when energy consumption is low and solar energy production is high, the water is pumped through the pump to an upper basin at a higher level, thus storing energy for a later point in time. In turbine mode, when energy consumption is high and PV output is low, the water now flows back into the lower basin and drives the centrifugal pump, which now acts as a turbine. This can both optimize own energy consumption and reduce the amount of energy drawn from the grid, thus reducing the load on the grid. The turbine is to be speed-controlled by a frequency converter. This will ensure that the turbine can be operated efficiently over the widest possible operating range while maintaining its limits (minimum & maximum flow).

Plant concept:



There are some requirements to be met for the location:

- A PV-system should be available
- One of the two storage basins should already exist
- Sufficient head should be available, preferably 60-80 m
- A company with sufficient energy consumption should be on site
- If no site can be found that meets all the conditions, assumptions can also be made in some parts

Tasks:

Design a MPS-System using the above specifications including:

- Research of suitable sites (one or more) for the construction of an MPS. If no suitable site can be found, a fictional site can also be selected. Optimally, the location should fulfill all the conditions listed above.
- Research on the required components and designs. E.g. piping, laying and fastening of the pipeline, closing elements, etc.
- Research the prices of components and work required (e.g., piping and storage costs, cost of laying the pipeline, etc.). This also includes requesting quotations from manufacturers.

- If the exact boundary conditions of the location are known, the operation of the MPS can be simulated over the period of one year. The simulations are performed by the supervisor. Afterwards, the results have to be interpreted by the participants.
- The participants have to calculate the economic efficiency according to VDI2067 and the levelized cost of energy (LCOE) over a period of 20 years using the results of the simulation model and then interpret/compare the results.

Contact: Florian Lugauer, M.Sc., florian.lugauer@hswt.de