

# EUDP project 2020

## Underground Pumped Hydro Storage

*UPHS – large scale electrical energy storage*

### 1. Intro:

According to the Danish Energy Agency's latest projection, the Danish power grid will reach 100% renewable energy no sooner than 2028. However, we can already now see a demand for a more flexible and secure power distribution due to the fluctuating energy production and consumption. Most experts suggest energy storage systems as the most sustainable, ideally suited and lasting solution.

The aim of this project is to develop and test critical parameters for a technology that enables storing energy in water using an Underground Pumped Hydro Storage (UPHS) system. An underground water reservoir is established using a pressurised geomembrane covered with 15-25 m soil. Water is pumped into the reservoir in periods with surplus of electric energy. When required, the water is released from the system and a turbine and a generator regenerate the electric energy with an efficiency of 75-85%.

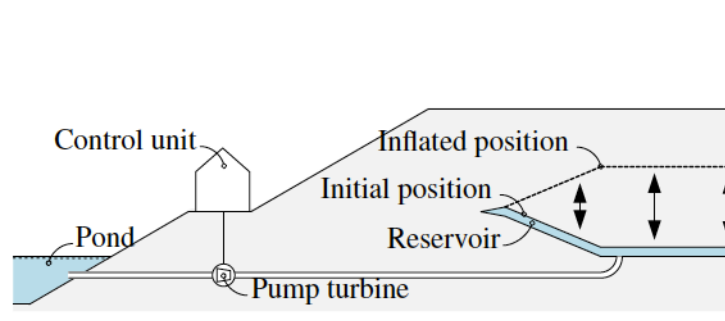


Figure 1: Functional principle of the Energy-Membrane Underground Pumped Hydroelectric Energy Storage.

### 2 Project goals – geotechnical aspects:

The technology has previously undergone two stages of development and this project covers the third phase with the following geotechnical focus;

Analysis, design and test of **geotechnical aspects** related to establishment of the UPHS. This will be done by improving existing numerical simulation models as well as testing of downscaled physical models (lab and field models), enabling:

- Study of energy loss in the storage system during charging & discharging
- Degree of disturbance to the overburden soil during deflation & inflation of the membrane
- Study of impact of different soil types and conditions
- Study of different shapes of the membrane with respect to both wear-out and efficiency
- Knowledge to ensure stabilizing of the soil during charging and discharging, minimizing energy loss in the soil

Furthermore, it is the objective for this project to prepare the technology for the next phase, which includes construction and test of a full-scale demonstration plant with fully commissioned pump and turbine.

### 3 Time line & Application deadline

Expected project start as early as possible

Project duration: 1.5-2 years (extensions are possible if additional funding will be acquired).

Please submit a CV including academic references to Assistant Prof. Hans Henning Stutz: [hhs@eng.au.dk](mailto:hhs@eng.au.dk)