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Size and Cost Modeling of a Ground-Gen Magnus Effect Airborne Wind Energy System

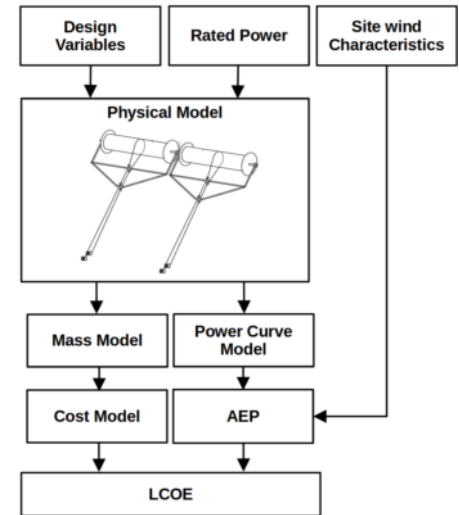
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One of our primary concerns at Wind Fisher is being able to prove the cost-efficiency of our system in order to ensure a successful entry in the energy market. To achieve this, we are developing a technico-economic model of our Ground-Gen Magnus Effect AWES.

Unlike most systems based on rigid or soft wing kites, our system consists of two cylindrical wings, which are helium inflated textile balloons with a rigid reinforcement structure. Wing rotation is driven from the ground using four drive-train units which simultaneously generate electricity. The winches are connected to four ends of the two cables wound around each cylinder. Models found in the literature, such as the reference model [1] currently under development, are not entirely suitable for our system architecture. We therefore need to establish our own model to account for the unique characteristics of our system.

The inputs of the model are the design variables (the most important being the aspect ratio of the kite), the desired rated power and the site wind characteristics (shape and scale parameters). The model's structure, as shown in the figure, contains a physical model which consists of simplified steady-state formulas [2] that are used to obtain the size of the kite and inputs for the mass and cost model such as maximum reel-out power and tether tensions, it also provides the power curve that is used to calculate the Annual Energy Production (AEP). Finally, Utilizing the system's cost (CAPEX and OPEX) and the AEP we can calculate the Levelized Cost of Electricity (LCOE). The aim is to be able to perform sensitivity analyses and optimize design choices to minimize the LCOE.

In this talk, we will give an overview of our model along with some results and conclusions.



Architecture of the size and cost model.

References:

- [1] Joshi, R., Trevisi, F., Schmehl, R., Croce, A., Riboldi, C.E.D.: A Reference Economic Model for Airborne Wind Energy Systems. Airborne Wind Energy Conference (AWEC 2021), Milan, 2022.
- [2] Smith, G., Tardella, A., Boucheriguene, Y.: Magnus Effect Kites: Optimal Reel-Out Speeds for Cross-Wind Power Production Including Simulation and Test Results. Airborne Wind Energy Conference (AWEC 2021), Milan, 2022.