TUM-BWL Project Study

Market Analysis and Product Conceptualization for a "Drag Power" Kite

Contact/Applications to:

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Motivation

Power generating kites have the potential to generate clean energy at a low cost competitive with coal power plants or even more economic without subsidies (see e.g. [1, 2, 3] and references therein). "Drag power" kites generate power with onboard wind turbines and generators by flying fast crosswind motions, see Fig. 1. Electrical power is transmitted to the ground at a medium voltage level via electric cables in the tether.

Figure 1: 600 kW "drag power" prototype of Makani Power/Google (image source: https://www.solveforx.com/media/story/makani/hero.jpg, accessed: March 7, 2016).

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At TUM, we have been developing a novel drag power kite design which promises very high power densities, such that a relatively small kite can generate already a high power. To demonstrate and validate the novel design, a 4 m wing span kite with about 20 kW electrical power is planned. Such a kite might be already economic in certain niche markets. Instead of developing a large multi-megawatt kite as a first product, it is meaningful to develop first smaller kites in several steps—and sell them to accumulate flight hours, experience and reference projects at relatively low costs/risks.

Tasks, Suggested Solution Approach, Expected Results

The primary research question for this TUM-BWL project study include:

- Can the 20 kW demonstrator be turned into a profitable product e.g. for self-consumption or for island grids, where no grid-parity is required and instead much higher costs of energy compared to the public grid are viable?
- Who would be the customers and what exactly do they expect ("Voice of Customer", i.e. economic values like return on equity, cost of energy, life-time, but also other values like land use etc.)?
- Small kites will have an ISO-container as ground station without the need for foundation. The ground station is therefore mobile. Are such properties interesting to some customers?
- Are there other possible niche markets?
- What are reasonable scaling-up steps for the kite? In which markets can those be sold?
- How big are the markets for each such scaling-up step?
- What are competing products for each such scaling-up step and what is required to be competitive? What performance figures are required?
- What are the material costs (approximately) and the profit for each such scaling-up step? When is break-even reached?
- Through what channels can such systems be sold (e.g. is a simple online shop already enough)?
- What are market barriers and how can they be overcome?
- What services and warranties do customers expect?

To solve the tasks and find answers to the questions, first a literature survey shall be conducted. Next, interviews of identified possible customers shall be prepared and conducted. Based on the interviews, drag power kite products shall be conceptualized with steps from small scale kites (20 kW) up to first grid-parity kites (several 100 kW). The work and the findings are to be documented in a report.

Starting Point

This announcement, the literature list below and additionally provided simulation files and internal documents upon start.

Report and Presentation Guidelines

One report and at least one presentation of the results are required. Guidelines and templates can be downloaded from e.g. from http://www.eal.ei.tum.de/studarbeiten/.

Your Profile

This TUM-BWL project study will be jointly supervised by Prof. Dr. Henkel and Florian Bauer, M.Sc. A student group with 2 to 5 students shall send a joint application (brief email in which you introduce yourself). The ideal candidates are

- students in TUM-BWL, mechanical engineering, electrical engineering, math, informatics or related fields,
- have experience/knowledge in economics (BWL),
- have experience/knowledge in MATLAB, Office, (LaTeX,)
- are motivated in the respective field of science and engineering,
- have good English and German language skills.

References

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