

On the way to small-scale Wind Drones: A networked approach

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Small scale Wind Drones

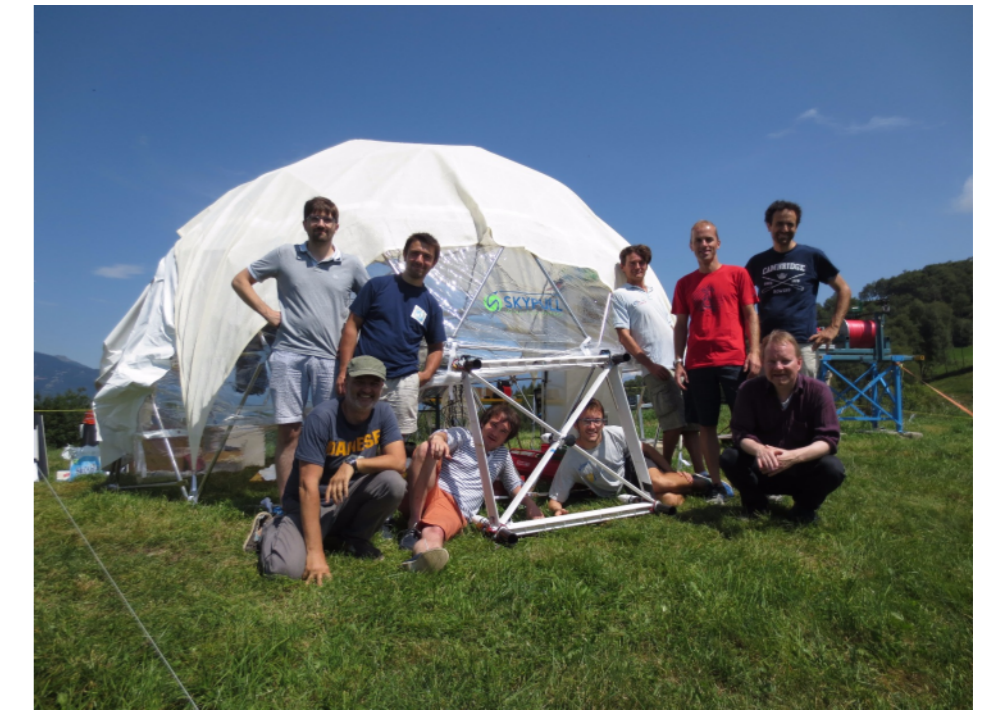
In 2016 Uwe Fechner presented the paper "Downscaling of Airborne Wind Energy Systems" at the Torque conference in Munich. Here, we report on our efforts in the development of small-scale Airborne Wind Energy (AWE) systems with vertical launch and landing. We are trying to accelerate development of small-scale Airborne Wind Energy systems by providing the key components that are always needed but not yet available off-the-shelf. We aim at reducing development costs for any AWE startup, but also to provide components and systems for educational purposes.

Control System Development

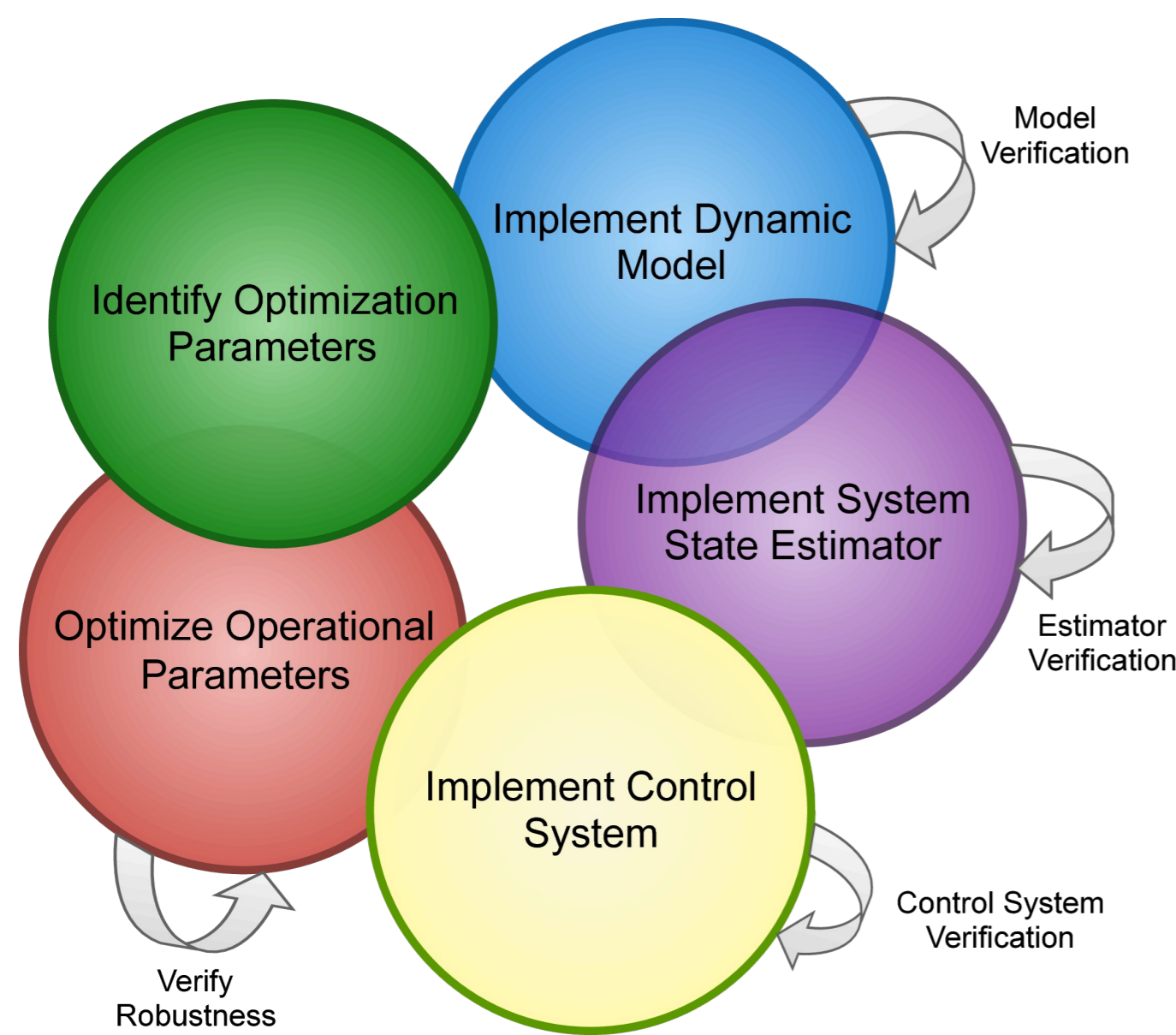
We are currently working on the development of the flight control system for the Dutch company e-kite and the Swiss company Skypull.

This has a lot of synergies, because the control of the power cycle is quite similar.

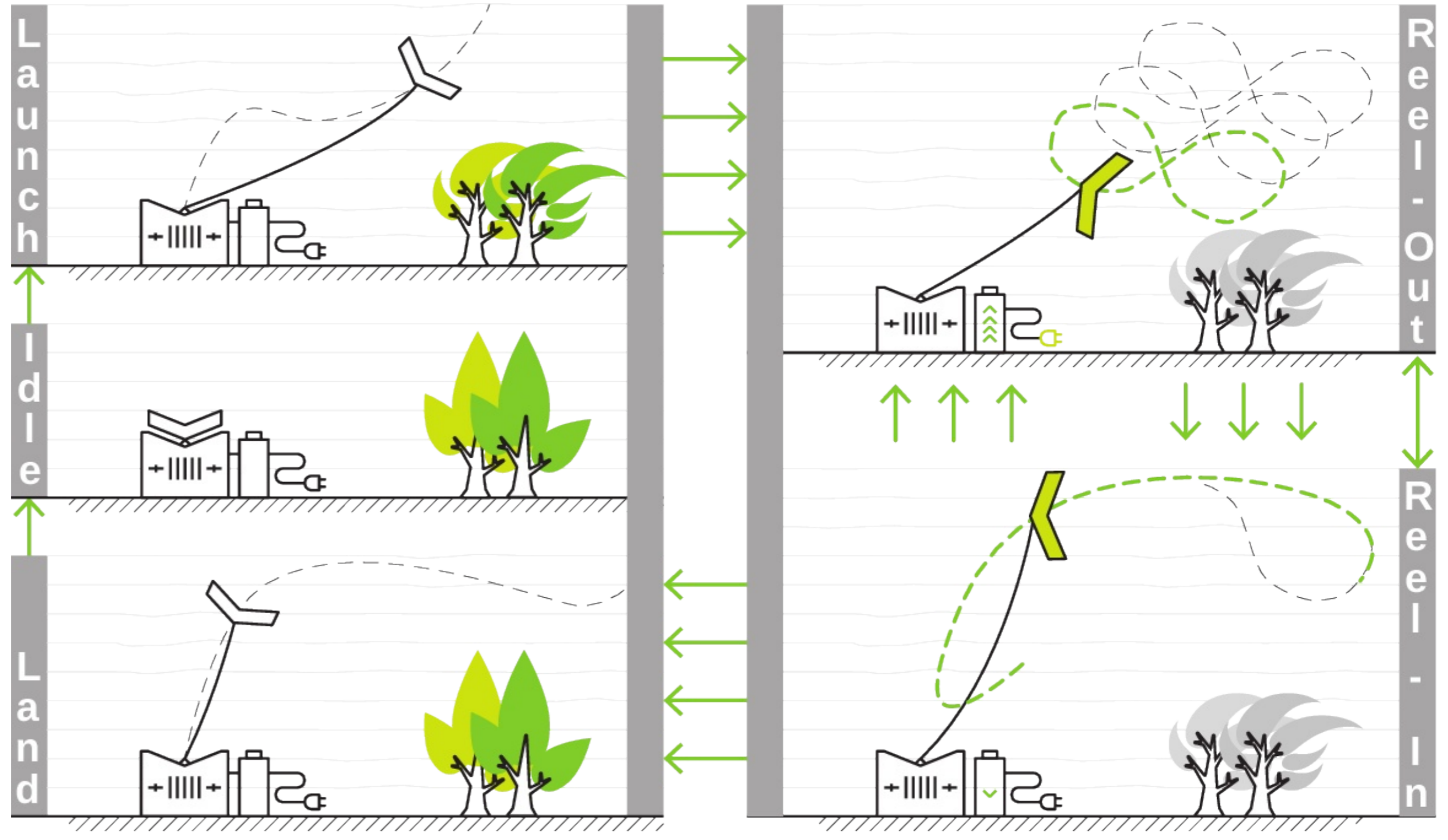
On the left a picture from a flight test in the Swiss mountains.



Development Approach



Principle of Operation



Products for the airborne wind energy industry

The Problem

Globally 1.2 billion people are without access to electricity, and in particular women have to collect fire wood



and suffer under the bad air in their houses.

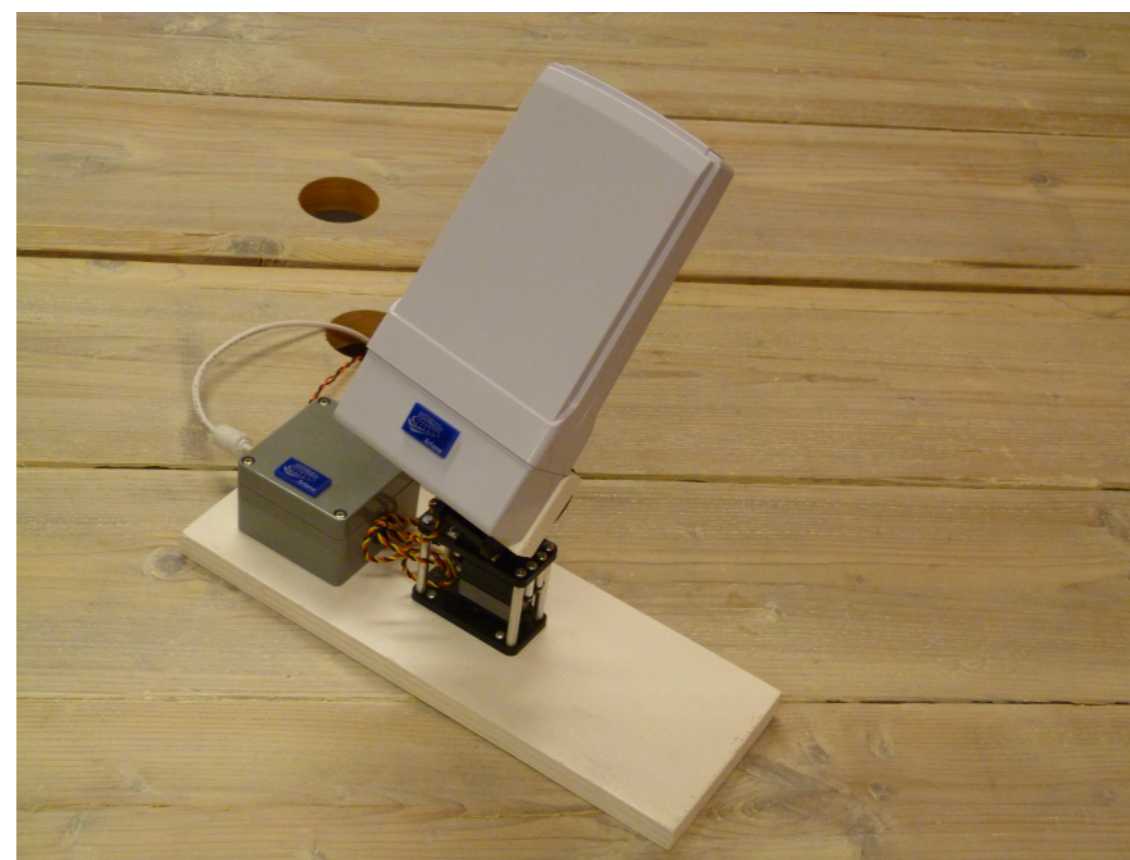


The Solution

Portable wind energy systems, using "Wind drones" (a hybrid of a tethered plane and a drone) use a flying wing with vertical take off and landing. The systems can be transported and installed by just one person and can harvest 8 kWh per day. They are harvesting the wind from 60 m height, where the wind is much stronger and steadier than at the height reachable by small scale turbines. The system shall provide power for small businesses in rural areas of India and Africa.

Ariane - fast wireless link

Ariane is our fast and reliable wireless link. It uses an antenna tracker to achieve a range of 1 km at a high data rate (> 1 MBit per s).



To achieve a good reception for any orientation of the wing at least two small, unbrakable antennas have to be attached to the wing.

For increased reliability it can be combined with a backup link, working on a different frequency.

Athena - flight control computer

The core component of the flight control system is our flight control computer Athena. It is compact and powerful. If compared to the well-known Pixhawk controllers, Athena is more than 10 times as fast and has more than 1000 times the RAM memory. High-end sensors for orientation and height are integrated, other sensors can be connected. It provides CAN-bus, I2C, high speed analog and serial interface connectors.



A fast wireless transceiver is integrated which allows the use of ground based sensors in the control loop. Up to five antennas can be connected. Basic driver and control software is included. Client specific software development for competitive costs on request.

[1] Fechner, U. "A Methodology for the Design of Kite Power Control Systems" PhD Thesis, Published by the author (2016), ISBN: 978-94-028-04909-6

[2] Ahrens, Uwe, Diehl, Moritz, Schmehl, Roland (Eds.), "Airborne Wind Energy", Springer publishing (2013), ISBN: 978-3-642-39965-7

[3] Fechner, U., van der Vlugt, R., Schreuder, E., & Schmehl, R. (2014). Dynamic Model of a Pumping Kite Power System. (Submitted to) Renewable Energy.

[4] Fechner, U., & Schmehl, R. (2012). Design of a Distributed Kite Power Control System. In Proceedings of the IEEE Multi - Conference on Systems and Control. Dubrovnik, Croatia.