# Optimised Energy Harvesting using Polypower

***Lasse Emil Korff***[1]

[1]DTU Elektro, Technical University of Denmark
s061985@student.dtu.dk

In the recent years - and not at least the days around COP15 in December 2009 - the discussion of global warming has been emphasised. Politicians are looking in all directions for a solution, and this may fully or partly be sustainable energy. The technologies of sun power and wind power energy are getting more and more developed, where the wave power energy only seems to draw few people's attention. Today we find a huge amount of unused energy along our shores all over the world. The Dielectric Electro Active Polymer technology may possibly help to solve some of the problems, such as storm protection and very expensive prototypes, which seem to be the reason for this lack of interest. Research shows that a mass production of DEAPs possibly may result in wave power generators which are even cheaper than atomic power generators. The DEAP technology "Polypower" has a wide range of opportunities. This project illustrates some of the potential for energy harvest using DEAPs and the issues concerning the design of a converter to extract the generated energy by using Polypower as a testing material.
Dielectric electro active polymers change capacitance when stretched. By using the change in capacitance it is possible to harvest energy.
Investigation of the Polypower material combined with an analysis of different converter topologies has proved that the buck-boost approach with a bidirectional power flow is the optimal choice of topology.
Components for the circuit were chosen based on the losses they would dissipate in the circuit. To do this the current tailing phenomena of the IGBT in use was modelled and several Matlab scripts have been made.
In order to control the charging and discharging of the Polypower material a DSP was programmed with input from a feedback circuit and capacitance measurement system that was also constructed. By measuring the capacitance of a smaller piece of film insulated from the rest of the film, it was possible to sense the stretching of the Polypower material.
Magnetic design of an inductor and a transformer to insulate one of the gate drivers used, was designed and constructed.
The full system was constructed and tested on 1 m2 of Polypower film, first at low voltages and then at high voltages.
Due to losses it was not possible to harvest energy at low voltages. This was most likely caused by the current tailing phenomena of the IGBT in use. At high voltages a short circuit occurred that destroyed the circuit and the ability to test any further. Due to time issues, the circuit could not be rebuilt and it has therefore not been possible to measure the efficiency of the converter.