

Hydropower / Pump Storage

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INTRODUCTION

In modern society we see a growing will and need to replace carbon-emitting energy sources with sustainable solutions. A considerable part of these solutions, such as windmills, depend directly upon forces of nature. Thus, while using such energy sources, we won't necessarily see a balance between production of and consumption of electricity. Our project is to even out this unbalance by pumping water to a high place at times with excess energy on the grid, and utilize the resulting potential energy at times with low energy on the grid. Using a hydropower system in such a way is referred to as "Pump Storage".

The system we use was made by students at DTU in 2011 and is in the possession of the Department of Electrical Engineering. We wish to demonstrate a control of the system such that it produces an output at 230 V and 50 HZ +/- 10%, which is the general requirement for usual electronics. Further we wish to enhance the existing system with respect to the flow of water through the pipes and turbine from upper to lower container.

THEORY

We will use theory from fluid mechanics in order to enhance the flow of water through the system. Furthermore we will use theory from literature about control systems.

METHODS

We will work on making a model that describes the system. From this model of the physical system we wish to make a control system that accounts for the resistance connected to the generator and makes sure that a right amount of power is produced.

RESULTS

This part will contain results on improvements we have reached concerning the efficiency of the system and a description of the developed control system.

CONCLUSION

The overall point of this project is to make an efficient model-scale hydropower system that can work as a pump storage unit. This is an ongoing progress that started with students who wanted to model a hydropower system in 2011, and now in 2012, continued by this project that has made a great deal of enhancements on the existing system. In years to come further projects can be developed to make an even more efficient hydropower system that has even more uses.

The parts on Theory, Results and Conclusion will be deepened in the final abstract.