ENTRANCE
CENTRE OF EXPERTISE ENERGY

Power (efficiency) improvement for small wind turbines at ENTRANCE

Client	Windmolens Op Maat in cooperation with Hanze Wind Energy
Related project	PUMSWindT2, development of Small Wind Knowledge
Start date	February 2025
Suitable for training course(s)	Internship and Graduation project for Bachelor, EMRE Master, or other MSc program with affinity for mechanical engineering as well as electrotechnical engineering
Learning Community	Wind Energy

Assignment description

Wind turbine blades have a large influence on the overall performance of a wind turbine, big or small. Aerodynamic shape influences the performance, but also aerodynamic imbalances (such as pitch misalignment) and mass imbalances (such as infiltrated liquid). These problems not only negatively impact the turbines energy output through reduced aerodynamic efficiency, but also decrease the lifetime of components like the drivetrain due to unbalanced loading.

Figure 1: 5kW Braun Antaris Wind Turbine @ EnTranCe

Also the functioning of transmission and the generator system itself and the connected power control system cause inefficiencies that will influence the electrical power output of a wind turbine. To quantify these inefficiencies a supplier of a wind turbine in most occasions comes with a power curve (and sometimes also a power efficiency curve) to show the total efficiency of a turbine. The professorship of Wind Energy would like to help companies with theoretically calculating and then verifying this power curve. But also check these values with actual measurements, so that the model can be validated. This will then enable the professorship to trace down possible improvements on the wind turbine design and/or installation, and thus help the Wind turbine manufacturer further improve its products.

So to ensure that a good basis is known for what a particular wind turbine can actually produce, a calculation (model) is necessary of what can be expected from the wind turbine in terms of yield. This will be tackled in two ways: on the basis of a theoretical model, and also (as verification) on the basis of actual measurements. Other students already have laid a basis for this project. This new assignment will be a part of an ongoing development.

Assignment

The professorship Wind energy participates/leads currently in the PUMSWindT2 consortium (Performance Upgrade of Medium and Small Wind Turbines). This project is almost to its end (April 2025), but a lot of interesting and useful developments are waiting to be further worked on. One of these projects is to work on the Braun Antaris Wind turbine (see Figure 1 on the previous page). This windturbine has been installed last summer at EnTranCe. The assignment for the student consists of two parts:

1. Develop a theoretic calculation model for the EnTranCe wind turbine Braun Antaris. A model must be made of the blades (e.g. by scanning), the generator and its (power) control system. The Braun does not have a transmission system, but it is also required that the student will be able to include such part in the model, as the model should also make it possible to be used for other small wind turbines in future.
2. Develop and test a data acquisition system for so that actual wind data can be combined and used together with generator output data. The following data should be made available into this to-be-developed data acquisition system:
    a. Wind speed sensor (already available in the system via an anemometer as a separate measurement);
    b. Wind direction sensor;
    c. Voltage measurement (already available in the system as a separate measurement);
    d. Electrical current measurement (already available in the system as a separate measurement);
    e. If possible: rotational speed and rotor torque;
    f. Any other variable that is defined as valuable during the research phase.

The assignment focusses on detailing out a plan of action to develop the calculation model and parallel to this actually implement a measurement system and possibly execute measurements. Research needs to be done to define the required measuring systems with an estimate of costs, and to define whether/how such tests can be done at the EnTranCe facilities with the existing system. A design of the set up needs to be made, that needs to be specified into a detailed design after approval. The student will then start to build the system, or otherwise report recommendations that will enable successors to further work on the project.

The project is done in collaboration with Wind turbine manufacturer Windmolens Op Maat, supplier of the Braun Antaris.

The student is given a large degree of freedom to shape the project himself, whereby the associated responsibility and ownership is expected from her/him.

General information

Final Product	To successfully complete the projects, the following possible steps can be considered, for example •Literature and experimental research (important source reached is: “Long term research agenda of the European Academy of Wind Energy” and “Current status and grand challenges for small wind turbine technology”) •Theoretical calculation model •Research and advice report with measurement results •Design of the proposed measurement system and actual building •Actual measurement and testing if time permits
Location	EnTranCe
Parties involved	WindMolens op Maat, professorship Wind Energy
Contact person	Arjen de Ruijter (professorship Wind), Teun Hulst (Windmolens Op Maat)
Guidance	Process guidance from the professorship Wind Energy, expertise guidance from company Windmolens Op Maat
Details	

Photo and/or video

For more info on Windmolens Op Maat, please visit their website:
https://www.windmolensopmaat.nl/

What are we and where can you find us?

EnTranCe is a learning knowledge community, in which students and teacher researchers from various programmes work together with researchers, companies, governments and civil society organisations to accelerate the energy transition.

EnTranCe is the place where, as a student, you work together with lecturers, researchers, businesses, governments and/or civil society organisations on complex issues. We do this at the following locations:

- Location Proeftuin, Zernikelaan 17

- Location Energy Academy Europe, Nijenborgh 6.

What do we offer?

EnTranCe offers you a multidisciplinary, inspiring learning, working and research environment in which you can develop the competencies needed to shape and accelerate the energy transition. There is room for collaboration with professors, researchers, lecturers and the professional field. In addition, you will be supervised by professionals who are part of the EnTranCe Learning Communities (ELC).

Contact us

Are you interested in the vacancy? Do you have questions or would you like to apply directly?

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