



UNIVERSITEIT STELLENBOSCH UNIVERSITY
FAKULTEIT INGENIEURSWESE FACULTY OF ENGINEERING

STELLENBOSCH UNIVERSITY WIND ENERGY RESEARCH

The Electrical Energy Group (EEG) at the Department of Electrical and Electronic Engineering of the Stellenbosch University (SU) focuses on electrical renewable energy conversion as one of its main research areas. In renewable energy, currently, the research and development is mainly on wind energy technologies and grid connection.

Group members

Prof Maarten Kamper	(Wind generator design and drives)
Prof Johan Vermeulen	(Wind farm power system modelling and simulation)
Dr Johan Beukes	(Power electronic grid-connected converters and control)
Dr Roger Wang	(Finite element analysis, machine design and magnetic gearboxes)
Prof Theo Von Backström	(Turbine blade design)

Areas of expertise and facilities

The department of Electrical and Electronic Engineering has excellent laboratory and test facilities that include three large, world-class laboratories on high voltage, power electronics and electrical machines. Tests in these laboratories can be done at power and voltage levels of up to 400 kW and 400 kV respectively. Direct drive tests on wind generator systems can also be done at power levels up to 400 kW.



Figure 1: Antarctic 20 kW direct drive PM wind generator under test in the EMLab laboratory.

Current wind energy research projects and initiatives

The EEG and more specific the Electrical Machine Laboratory (EMLab) are involved in a number of wind energy projects and studies. These are listed as follows:

- Development of a 3 – 4 kW permanent (PM) wind generator for direct battery charging stand-alone supplies for rural areas; this development is in collaboration with small South African (SA) industry. An example of this type of generator is shown in Figure 2.
- Development of three 20 kW direct drive grid-connected iron-cored PM wind generator systems for the SA Base IV in Antarctic. The first of these systems will be installed at this base in January 2010 and the last one is planned to be installed in January 2012. A

photo of this fully SA manufactured wind generator system is shown in Figure 3; the laboratory testing of the generator is shown in Figure 1.

- Design and testing of the first South African 300 kW grid-connected PM wind generator system; this generator system is in production in Pretoria. The electromagnetic generator design and the development of the 400 kVA grid-connected power electronic converter were fully done by the EMLab. A photo of the generator is shown in Figure 4.
- Modelling and control of grid-connected wind farm power systems with doubly-fed induction generators systems.
- Design and development of magnetic gearboxes for wind generators.
- The EMLab jointly with the Department of Electrical Engineering at the University of Cape Town (UCT) received a 5-year grant from the South African National Energy Research Institute (SANERI) for research on wind energy technologies. This collaboration forms a so-called "wind spoke" of the Centre of Renewable and Sustainable Energy Studies (CRSES) at the Department of Mechanical and Mechatronic Engineering at the SU.

Recent initiatives and proposals from the EMLab are the following:

- An initiative has been taken between the EMLab and the Department of Mechanical Engineering at the North West University for the development of a SA manufactured 50 kW grid-connected wind generator system.
- The EMLab recently proposed to the SU the design and development of a 1 MW R&D and training wind farm consisting of 20 x 50 kW wind generator systems. This is still a proposal and the SU is hoping to get funding for such a wind farm.

Research collaboration on wind energy technologies is currently with the University of Cape Town (UCT) and the North West University (NWU) in Potchefstroom.

Contact

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Figure 2: 3 kW wind generator being tested in front of the engineering building



Figure 3: Antarctic 20 kW wind generator



Figure 4: Unloading the 300 kW permanent magnet generator for testing at the EMLab.