

2011 年臺灣國際科學展覽會

優勝作品專輯

國家：New Zealand

編號：100033

作品名稱

Wind Power

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作者姓名

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Abstract

My school requires year 13 students to complete a year long project of a topic of their choice, culminating in the presentation of a thesis, a display and speech to a public audience. Many different topics appealed, but in the end I decided to build a micro wind-turbine. I have always been fascinated with mechanics, mathematics, engineering, aerodynamics and electricity. A wind turbine is a mixture of these technologies, with the overall goal of electricity production. In a world that is starting to see the true costs of fossil fuels, renewable energy seems to be increasingly popular and the demand for electricity is always growing.

I was aware that building a wind-turbine from the foundations up wouldn't be easy. Many of the experts I contacted in the early days cautioned me against trying such a complex thing in one year, at the same time as completing a full Year 13 course. There were, however, people prepared to support me. Michael Lawley, who builds micro wind turbines in New Plymouth was very helpful, just full of priceless knowledge and gave me a few basic parts to start with. The knowledge gained from Doug Clark, who also builds his own 11 kW wind turbines, was such an inspiration. Later I had practical help from Wilson Springford and Darron Matthews.

I investigated and documented the history of and current state of wind technology, as well as my own experience and learning in the design, construction and testing process. I thought it would be interesting to find out how the electrical and mechanical side works.

The generator, a washing machine motor, needed to be completely rewired, and converted to DC (direct current) from AC (alternating current). I built my own 3-phase

AC to DC converter.

Other parts like the disc brakes and bearings had to be found. The rest was hand-made and every part, to a certain extent, had to be modified. Probably more than twenty braking system design attempts led to the final decision to incorporate the wind-activated hydraulic disc brake where the wind paddle starts to ease the brake on over a certain wind speed.

I studied the dynamics of wind turbine blades, their shape, the material they were made from and how this affected their performance. The decision to make my own blades helped me gain a great sense of achievement and knowledge of blade design. I found some New Zealand made 100% recycled plastic pipe, an added bonus because I wanted to have minimal environmental impact. I designed the turbine with three blades to give better starting torque along with a lower top speed, perfect for how I wired the generator.

I designed the swivel, the part of the wind turbine that enables the power cables to get from the turbine down the tower without twisting up and has the job of carrying the whole turbine, which is mostly made from recycled aluminium. The steel and bearings used to create the swivel were all second-hand parts and materials. The power from the turbine passes through the swivel into the cables and down the tower. The main mast of the tower is a little over 4.7 metres and pivots on two shorter supporting poles which go down around 2.6 metres to the bottom of the reinforced concrete foundation.

I managed to, design and construct an operational prototype micro wind-turbine, incorporating recycled and recyclable materials as much as possible, with the end result surpassing all expectations.

By Shahn Taylor

評語

本作品是自製微型風力發電機。重要零組件包括發電機、葉片等皆為自製而成，並成功的示範其發電的可行性。作品相當完整，是一件成功的工程作品。