# CALIFORNIA STATE SCIENCE FAIR
# 2005 PROJECT SUMMARY

**Name(s)**
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**Project Number**
**J0713**

**Project Title**
## Gone with the Wind: The Days of Oil Dependency

**Abstract**

**Objectives/Goals**
Developed alternative energy sources such as wind power would free this country from its dependence on foreign oil.
This project is a study of extracting electrical power out of the wind using a wind turbine with three rotor configurations, three angles of incidence into the wind under two different wind speed conditions.
The objective is to compare the power generated from various rotor configurations and each rotor configuration with its theoretical maximum power output calculated using Betz#Law.

**Methods/Materials**
In order to test these different rotor configurations, I built a wind turbine and a wind tunnel. I built the wind tunnel using a house fan I found in my garage. I built the turbine out of foam core, a brass rod, a gear, and an electric motor. I tested each configuration multiple times and I averaged the results from the experiments to make comparisons of performance and efficiency. Efficiency came from comparing the actual power output with the maximum theoretical output as calculated using Betz# Law.

**Results**
My hypothesis was proved incorrect as the most effective wind turbine blade configuration was the rotor with four rectangular blades set to a 19.6 degree angle. That configuration also proved to have the highest percentage of output compared to the theoretical maximum output. The four-bladed rotor also proved to be the most effective in the low wind speed setting.
The two-bladed rectangular rotor performed almost as well as the four-bladed rotor in the high wind condition, but did not turn at all in the low wind condition. The four-bladed rotor efficiency decreased approximately 26% with the increase in the wind tunnel speed.

**Conclusions/Discussion**
In both the high wind and low wind condition the four-bladed rotor was the most efficient and extracted the most power compared to the theoretical maximum. From the low wind condition to the high wind condition, the efficiency of all configurations dropped off dramatically.

**Summary Statement**
My project is about extracting electrical power out of the wind using different rotor configurations.

**Help Received**
My science teacher, Ms. Margulis, helped me to fix problems in my report and helped me design my project.