1. **DESCRIPTION:** Teams will build a blade assembly that consists of any kind of propeller/pinwheel/rotor attached to a compact disc (CD), which will be used to capture wind power and generate voltage. Students will also be tested on their knowledge regarding alternative energy.

A TEAM OF UP TO: 2 **EYE PROTECTION:** #2 **IMPOUND:** Yes **APPROX. TIME:** 50 minutes
(See Eye Protection #2 on www.soinc.org)

2. **EVENT PARAMETERS:**
   a. All reference materials to be used during Part II of the competition must be secured in a 3-ring binder, must be 3-hole punched and inserted in the binder so that regardless of orientation none can fall out. Materials such as pencils, pens, protractors, rulers, nonprogrammable calculators, and any other similar tools may also be used during the set up and activity.
   b. Blade assemblies must be placed in a box (assemblies and box must be labeled with the team #) and **must be** impounded.
   c. Team members must bring and wear Safety Spectacles with Side Shields during Part I of the event, but they need not be impounded.
   d. The supervisor will provide a **20" multispeed box fan to be used as the wind source for testing the rotor blades** and all testing materials, which will be the same for all teams, including: the fan(s), ring or similar stand (which allows for vertical and horizontal adjustments of the blade assembly), a clamp(s) (to allow teams to orient the mount to any angle with reference to the fan), a motor/generator (a portable CD player motor will be used at Nationals), and a voltmeter, probe or multi-meter to record voltage. Consult www.soinc.org for a sample setup. Other motors/generators may be adapted for CD attachment to record voltage.

3. **CONSTRUCTION:**
   a. Each team may bring one pre-constructed blade assembly attached to a standard CD **in the C Division or up to two pre-constructed blade assemblies in the B Division**.
   b. The CD must fit on the mount found in a standard CD player. Modification of the CD (except for the center hole) is allowed. When mounted, the blade assembly must **have a maximum diameter between 20.0 and 24.0 cm for B Division and 25.0 and 28.0 cm for C Division.** The blade assembly may be made of any nonmetallic substance. Commercial blades (modified or unmodified) are **not** permitted.

4. **THE COMPETITION:**
   Part I:
   a. There will be two stations **in the B Division** (one high speed and one low speed) to test the blade assemblies **and one multispeed fan in the C Division to test both speeds**.
   b. The fan(s) must be mounted in a fixed position with the bottom of the grill at least 15 cm above the table.
   c. The blade assembly can be oriented and placed in any position or angle in front of the fan. The teams must mount their blade assemblies to the motor/generator and position / orient them in front of the fan prior to the fan starting. Students **in B Division** may use either blade assembly in front of either fan. **In both divisions** once mounted, blades may not be modified or switched **except between runs**.
   d. When the students are ready, they will tell the event supervisor who will then start the fan, **start** the time and begin recording the highest voltage during a one-minute time period. **Voltage will be recorded in millivolts (mV).**
   e. Teams **in B Division** must set up and complete the blade assembly testing within a 5 minute period at each fan. **C Division teams must complete set up and both high and low speed testing in 5 minutes.**
   f. **The teams may give their blade assembly a single tap to start it spinning once the fan is turned on.**

Part II:

g. **Teams will be given a set amount of time (20-30 minutes is suggested) to complete a written test.**
h. **The following topics may be included:**
   i. **Basic information and definitions about energy, work, heat and heat transfer including, but not limited to concepts of heat, temperature, temperature scales, thermal energy, conduction, convection, radiation and insulation.**
   ii. **General information about renewable energy including but not limited to solar, wind, hydroelectric, tidal, oceanic tidal energy currents (OTEC), and geothermal.**
   iii. **General information about energy conservation practices including but not limited to recycling, reusing, and using materials with greater efficiency.**
   iv. **Mathematical relationships and equations used in determining heat loss and heat gain, specific heat, and heat transfer calculations.**
   v. **In C Division formulas to determine power, energy consumption, cost effectiveness, etc. may also be required.**

5. **SCORING:**
   a. **The score for Part I is the sum of the low speed voltage (mV) + high speed voltage (mV).**
   b. **If the device fails during a run the score at that speed will be zero.**
   c. **The Part II written test will be worth a total of 50 points.**
   d. **A team's final score will be determined as follows (with highest score winning):**
      Final score = 50 x (Part I score / Highest Part I score of all teams) + Part II score
   e. **Ties will be broken by the best high speed voltage.**

RECOMMENDED RESOURCES: http://www.alliantenergykids.com, American Wind Energy Association at www.awea.org, and **www.kidwind.org.**

NATIONAL SCIENCE EDUCATION STANDARDS: Content Standard B: All students should develop an understanding of motions and forces and transfer of energy. Content Standard E: All students should develop abilities of technological design and understandings about science and technology.