Teacher Guide

In order to best prepare teachers to help students understand the power in the wind and to mentor them throughout the process of turbine design and construction, we have created this page as a clearinghouse of useful information. If you still have questions that are not answered on this page, please contact Melody Moen at melody.moen@alaska.edu.

KidWind Challenge - Step by Step

<table>
<thead>
<tr>
<th>Deadline</th>
<th>Task</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anytime</td>
<td>Download Teacher Packet</td>
</tr>
<tr>
<td>Anytime</td>
<td>Submit application to <a href="mailto:mefrey@alaska.edu">mefrey@alaska.edu</a></td>
</tr>
<tr>
<td>With Application</td>
<td>Signed Model Waiver/Photo Waiver for each student and teacher. Photo Waivers of students MUST be signed by their parent/guardians.</td>
</tr>
<tr>
<td>After Application is Received</td>
<td>Your KidWind Packet with kit supplies will be mailed to you from the Fairbanks ACEP offices. These supplies are free of charge and provide a useful starting place for building your turbines. Kit contents are described below.</td>
</tr>
<tr>
<td>Anytime</td>
<td>Review the scoring criteria in the Teacher Packet. These sheets will give you detailed information on what is being judged in the competition, how to increase your team’s scores and additional Alaska requirements for the competition.</td>
</tr>
<tr>
<td>After Application</td>
<td>Perform the design challenge with your students. There are several curricula referenced in the Teacher Packet to use as a model for teaching this topic and incorporating the design challenge into your classroom.</td>
</tr>
<tr>
<td>February 28</td>
<td>Email <a href="mailto:mefrey@alaska.edu">mefrey@alaska.edu</a> to submit your wind output, team photos of wind turbine and model release forms.</td>
</tr>
<tr>
<td>March 18- April 1st</td>
<td>KidWind Challenge Judges will travel to top 3 qualifying schools to evaluate and grade the students final wind turbine project. If this does</td>
</tr>
</tbody>
</table>
not work for your schools timing please indicate that in your application packet.

<table>
<thead>
<tr>
<th>Date</th>
<th>Event Description</th>
</tr>
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<tbody>
<tr>
<td>April 18</td>
<td>Design Statement (presentation/report) submitted with appropriate identifying information included: team name, team members names (first and last), division (middle or high school), school name, teachers name(s).</td>
</tr>
<tr>
<td>April 18</td>
<td>Complete and submit your team presentations. Team Presentations are due no later than close of business. Email to <a href="mailto:mefrey@alaska.edu">mefrey@alaska.edu</a>.</td>
</tr>
<tr>
<td>May 1st</td>
<td>KidWind Challenge Champions winners will be announced and prizes awarded!</td>
</tr>
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</table>

**Challenge Details**

What will I receive in my kit for my classroom?

- 2 multi-meters to measure turbine output
- 1 small light bulb to act as a resistor
- 1 anemometer to measure wind speed
- 1 diagram to illustrate how to set up your turbine, fan and wires

What will I receive in my kit for each of my teams?

- 1 generator
- 1 hub for inserting turbine blades

How do I perform my classroom competition?

- Arrange your pieces (turbine, fan, multi-meters, anemometer and light bulb) according to the provided graphic.
- The anemometer in your kit is handheld and should be placed at the center point of the wind turbine with your fan running on high. Record the anemometer’s output measurement for reporting on your competition. This measurement will be used as a baseline comparison for determining the top qualifying teams.
- Set one multi-meter to measure volts and one multi-meter to measure amps, you will multiply the 2 outputs to identify watts produced (V x A = Watts).
• Turn your fan on high and record each team’s turbine output (reported in Watts).
• Email the following to ACEP’s Max Frey (mefrey@alaska.edu) to submit your challenge scores:
  o Community, school and teacher name
  o Wind speed of fan used (anemometer reading)
  o List of teams participating (including team name and student participant names)
  o Photo of each team’s turbine
  o Output of each team’s turbine (in watts)

You will be contacted by March 5th if one of your team’s have qualified for an official wind turbine judging. Judges will be traveling to the top 3 communities between March 18th – April 1st, 2014.

During the official wind turbine judging in my community:

How will the judges test my wind turbine?

Prior to testing wind turbines will be tested in a 48” × 48” wind tunnel at a wind speed of approximately 5 m/s. Please note: wind moving at 5 m/s within a space this large is surprisingly powerful, much faster than a single box fan. Test your device for high winds! This means watch for blade deflection and torque on your gearboxes. Student teams will be given a reasonable amount of time to test their devices in the wind tunnel. This will give you a chance to evaluate the conditions of the space.

Once the testing session begins you will be given two minutes to set up your wind turbine inside the tunnel. You must have two wires at the base of your turbine. You must label which wire is positive and which is negative. These wires will be attached to a circuit with the light bulb provided to serve as a resistor in series and will simultaneously measure voltage and amperage. In order to receive full marks for your turbine’s functionality, your wind turbine must be able to start producing power once the wind tunnel is activated without external assistance. The wind tunnel will be constantly running during testing. If your wind turbine slips, breaks apart, or falls over before the 60 second timer is started, you will either be given two minutes to set up your wind turbine again, or you will be allowed to remove the turbine to make repairs. In that case, you will be moved to the back of the line for retesting. You will only be given one restart opportunity. It may be granted before the 60 second test begins, or once it has begun—but not both. We will collect power output data for 60 seconds. Your energy output score will be calculated using a Vernier data logging system that collects voltage and amperage readings simultaneously. A sample of this file is available at www.KidWind.org.

Visiting judges have final say on rulings and protests.
Challenge Rankings

The total energy output of your turbine over the 60 second trial period will be collected.

Wind Turbine Score Based on Rank

1st Place           = 60 Points
2nd Place          = 55 Points
3rd Place           = 50 Points
4th Place           = 45 Points
5th Place           = 40 Points

Prizes Awarded

Prizes awarded by Alaska Center for Energy and Power at the University of Alaska Fairbanks

- Team Certificate of Participation and Placement
- Trophies for 1st, 2nd, 3rd place, each for middle school and high school division
- KidWind t-shirts for all participants of winning teams.

Rules, Resources and Judging Criteria

Our judges will be assessing students on several criteria during your community school visit including; Challenge Compliance in Design, Construction Quality, Innovation of Design and Demonstrated Knowledge of Wind Energy.

Below we offer some guideline questions the judges will be looking for while talking with the student teams. We will spend 5-10 minutes, if possible, with each team.

Challenge Compliance in Design

Did the students label their wires positive and negative? Did they have the wires at the base of their turbine? Do they have a team name? Has everyone submitted a model release for photos?

Construction Quality

Does it look like students took care in the building their turbine? Does it appear sturdy? What happens in the wind tunnel? Does it shake and shimmy when placed in wind?
What kinds of materials did the students use to build the turbine? Did they use recycled materials? Were they careful not to use any prefabricated kits for their turbine? How much did all the materials cost to build their device cost?

Note: Pre-made gears and gear boxes are okay to use, but students who build their own gear boxes are eligible for bonus points.

**Innovation of Design**

How creative were the students? Did they use gears? Did they try a vertical axis or horizontal axis? Why? Does it look like they spent considerable time on the blade design? Did they try things that did not work? How did they fix them?

**Demonstrated Knowledge of Wind Energy**

Do the students seem knowledgeable about wind energy and the design of their turbine? Did it seem like the students went through the process of design, testing and redesign? Do they seem to understand the basic engineering and physics of wind turbines? Did the team do things to reduce friction, improve balance, increase swept area or add a gearbox? Were these purposeful actions or random?

**After the community school visits, finalists will be required to submit a design presentation.**

**Design Presentation Criteria**

Did the students provide some form of design statement? Some options include: a short report, an engineer’s notebook, a short video, or a poster board. How neat is this statement? Does the presentation reflect their project? Does it reflect the personality of the entire team?
## KidWind Challenge – Application & Agreement Form

<table>
<thead>
<tr>
<th>Statement of Intent to Participate</th>
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<tbody>
<tr>
<td>_______________________________</td>
</tr>
<tr>
<td>(School Name)</td>
</tr>
<tr>
<td>_______________________________</td>
</tr>
<tr>
<td>(School Representative)</td>
</tr>
<tr>
<td>(School Mailing Address)</td>
</tr>
<tr>
<td>(City and Zip Code)</td>
</tr>
</tbody>
</table>

### Return of ACEP Supplies Required

All KidWind supplies will be returned to ACEP, ATTN: Max Frey.  
Alaska Center for Energy and Power  
University of Alaska Fairbanks  
PO Box 755910  
Fairbanks, Alaska 99775-5910

### Teams Participating

Number of classrooms participating ____________

Number of teams within each class ______________

Teams Participating are in  
- [ ] High School  
- [ ] Middle School


Meter Diagram

*Wind turbine stand and blades to be constructed by students/educators.
**Lightbulb may not light up. It is meant to act as a resistor.
# KidWind Challenge - Judging Sheet

**SCHOOL NAME:**

**DIVISION:** Middle School or High School

**TEAM NAME:**

**TEAM MEMBERS NAMES** (first, last - spelled correctly) **T-SHIRT SIZE**

<table>
<thead>
<tr>
<th>Turbine Output: 60 second test:</th>
</tr>
</thead>
<tbody>
<tr>
<td>(one restart is allowable)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>YES NO (can run, can’t place)</th>
<th>Signed UAF Model Release has been submitted for all team members.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>YES NO (can run, can’t place)</th>
<th>Did the turbine use the KidWind generator?</th>
</tr>
</thead>
<tbody>
<tr>
<td>YES NO (can run, can’t place)</td>
<td>Did the turbine have any prohibited components?</td>
</tr>
<tr>
<td>YES NO</td>
<td>Did the team follow all rules set by the KidWind Challenge?</td>
</tr>
<tr>
<td>YES NO</td>
<td>Was power generated solely by wind from the wind tunnel?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>YES NO (-2 power output)</th>
<th>Did students have wires at the base of turbine?</th>
</tr>
</thead>
<tbody>
<tr>
<td>YES NO (-2 power output)</td>
<td>Did students label wires positive/negative?</td>
</tr>
</tbody>
</table>

**OUTPUT SCORE:**
## KidWind Challenge - Judging Sheet

### School Visits - 15 points possible

### Construction Quality

| 5 POINTS | Wires visible at base of turbine. Wires labeled positive and negative.  
|          | Careful building of turbine. Sturdy construction. Turbine is freestanding.  
|          | Withstands wind in wind tunnel. Does not shake or shimmy in wind. |

### Innovation

| 5 POINTS | Team demonstrates creativity in turbine design.  
|          | Team demonstrates innovative use of materials in turbine design.  
|          | Team demonstrates reasoning for use of either a vertical or horizontal axis.  
|          | Efforts were made to use gears in turbine design.  
|          | Blade design reflects time and effort.  
|          | Team overcame obstacles and mechanical failures in turbine design. |

### Demonstrated Knowledge

| 5 POINTS | Team demonstrates knowledge of wind energy.  
|          | Demonstrates understanding of relevant engineering and physics concepts.  
|          | Demonstrates knowledge of their individual turbine design.  
|          | Demonstrates evidence of turbine design, testing, and redesign.  
|          | Efforts made to reduce friction, improve balance, increase swept area.  
|          | Efforts made to add gear boxes.  
|          | Improvements efforts reflect purposeful actions. |
## KidWind Challenge - Judging Sheet

- **Design Presentation - 25 points possible**

<table>
<thead>
<tr>
<th>Points</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 POINTS</td>
<td><strong>DESIGN PRESENTATION IS SUBMITTED ON TIME.</strong>&lt;br&gt;Some options include: report, video, conference poster, or presentation.</td>
</tr>
<tr>
<td>5 POINTS</td>
<td><strong>DESIGN PRESENTATION INCLUDES TEAM’S IDENTIFYING INFORMATION</strong>&lt;br&gt;(on Slide 1 or Page 1):&lt;br&gt;Team name&lt;br&gt;Team members names (first and last)&lt;br&gt;Division (middle or high school)&lt;br&gt;School Name&lt;br&gt;Teacher(s) Name(s)</td>
</tr>
<tr>
<td>5 POINTS</td>
<td><strong>Design Presentation is Well Prepared:</strong>&lt;br&gt;Describes and illustrates all stages of the design and construction process.&lt;br&gt;Neatly typed.&lt;br&gt;Reflects the team's individual turbine design project.&lt;br&gt;Reflects the personality of the team and the efforts and creativity of the team members.</td>
</tr>
<tr>
<td>5 POINTS</td>
<td><strong>Lessons Learned</strong>&lt;br&gt;Reflects on design, construction, trials and turbine testing.&lt;br&gt;Describes strategies for overcoming obstacles.&lt;br&gt;Describes lessons learned:&lt;br&gt;&quot;What would your team do differently if given the opportunity?&quot;&lt;br&gt;&quot;What questions remain with your team following this competition?&quot;</td>
</tr>
<tr>
<td>5 POINTS</td>
<td><strong>Demonstrated Knowledge</strong>&lt;br&gt;Team demonstrates knowledge of wind energy.&lt;br&gt;Demonstrates understanding of relevant engineering and physics concepts.&lt;br&gt;Demonstrates knowledge of their individual turbine design.&lt;br&gt;Demonstrates evidence of turbine design, testing, and redesign.&lt;br&gt;Efforts made to reduce friction, improve balance, increase swept area.&lt;br&gt;Efforts made to add gear boxes.&lt;br&gt;Improvements efforts reflect purposeful actions.</td>
</tr>
</tbody>
</table>
MODEL RELEASE

PRINTED NAME (please write legibly)

E-MAIL

SIGNATURE* DATE ADDRESS PHONE

CITY STATE ZIP

SIGNATURE OF PARENT OR GUARDIAN (IF MINOR)*

CLASS FR SO JR SR GRAD FAC STAFF MAJOR

UNIVERSITY OF ALASKA FAIRBANKS

*BY SIGNING THIS FORM, YOU AGREE TO THE TERMS ON THE BACK (SEE REVERSE SIDE FOR DETAILS) 04/06

Description________________________

DETAILS

BY SIGNING, I GIVE THE UNIVERSITY OF ALASKA FAIRBANKS (UAF) PERMISSION to take photographs or video of me and to use the photographs, video or audio in its print and Internet publications or productions, including advertising, signage and promotional materials. I also give UAF permission to use my name, academic class standing and major in an accompanying caption, if applicable. I agree that the photographs and video are the property of UAF and hereby release UAF from any and all claims that I may have from its use of my image or voice.