2019 Kansas KidWind Challenge – Rules and Logistics

Note: This document includes basic rules/logistics (for additional details, please see the National KidWind Rules. If you have questions, reach out to us (ksenergyprog@ksu.edu; 785-532-3351).

Logistics

- If you haven't yet registered, please do so as soon as possible, even if you're still missing some information (such as team names)! We are beginning to communicate directly with registered teams, so you may miss out on important information if you wait to register.
- You can choose the regional event that makes the most sense for your team(s).
- Each competition will be limited to 16 teams. If we receive more than 16 team registrations, we might contact schools and ask them to reduce the number they are bringing (for example, a school can host an internal competition and bring the top three teams).
- The top two teams in each division (4th-8th and 9th-12th) at each regional event will be invited to attend the statewide KidWind Challenge. The top two teams in each division at the statewide challenge will be invited to attend the national event.
- The tentative agenda for each challenge is as follows:
    - Registration: 8:30 – 9:00 a.m.
    - Competition: 9:00 a.m. – 2:30 p.m. (with time for lunch)
    - Wind industry expert presentation and winners announced: 2:30 – 3:00 p.m.
    - Depending on number of teams, the schedule is subject to change and we will reach out to registered teams to let them know of updates.
- We will be providing snacks and food at the challenges – please make sure to let us know if there are any dietary restrictions or preferences.
- Inclement weather policy: this is flexible and subject to change. In the case of inclement weather, we will be in frequent communication with coaches. If hosting the challenge on the scheduled date isn't possible, we will look at holding the event the following day, finding another solution, or cancelling the event.

Basic Rules *(most of this follows the National KidWind rules)*

Eligibility and registration

- Any group of students in grades 4 to 12 is eligible to enter a team, including students from public and private schools, home schoolers, after school clubs, Boy Scout and Girl Scout troops, etc. As long as you have a coach and a team, you can attend!
- There are no restrictions on the number of members on a team; however, large teams can be problematic as members may not have enough work to keep them occupied. Some large teams divide the students into smaller groups. Please contact us if you have questions on this! We typically recommend 3-5 students per team.
- Each team must have a coach. The coach will be responsible for registering the team for the competition and managing the team's progress.
- The coach will provide or be responsible for supervision of students at each challenge. We require one adult for every ten students who attend a challenge.

Turbines

- *General*
    - You cannot share any parts of your turbine between teams.
    - The entire turbine must fit inside a 48"x48" wind tunnel – allow some room! If any part of the turbine (including a shroud, if used) does not fit, it will be disqualified.
    - The turbine must be free-standing, as a tower/stand will not be provided. We will have some weights/sandbags to assist in holding the turbine in place.

    - Power must be generated solely by wind using the wind tunnel and turbines can be either a vertical or horizontal axis.
    - Unlike a typical box fan, the competition wind tunnel sucks wind through the tunnel instead of pushing it. This creates a more powerful and consistent airflow to streamline testing. This should not affect the design requirements for your turbine.
    - While you are allowed to use purchased parts (other than the blades), points will be awarded for creativity and economical use of resources.
    - When measuring power output from the turbine during the KidWind Challenge, it will be hooked up to a 30-ohm resistor to create a load, so don't forget to test it that way. If you need resistors, contact us.
- *Generator*
    - To compete in the general competition, you MUST use a KidWind generator (we can ship you some, if needed).
    - Because the National KidWind rules for the hand-built/advanced generator division are fairly new and most of the Kansas teams are new to the KidWind Challenge, we prefer to limit the Kansas regional and statewide challenges to using the KidWind generators from Vernier. If a team wins the state competition and wants to try the open generator division at the national Challenge, that will be up to the team.
- *Blades*
    - Teams cannot use pre-made airfoils
    - Blades and turbine should be made of safe materials (cardboard, balsa wood, 3D-printed material, etc.). Metal, Plexiglass, and similar materials are discouraged. If the local coordinators deem a turbine to be unsafe, it will be disqualified.
    - If your team 3D-prints the blades, please make sure the team is prepared to explain to judges how it used this process (the judges want to make sure the team understands the technology).
- *Everything else*
    - Your team can use KidWind gearboxes and parts, or you can purchase from other vendors, or create your own.
    - We will be using Vernier's Go Direct Energy Sensor (GDX-NRG) for testing – this includes a built-in 30-ohm load.
    - The approximate wind speed in the tunnel is 3.5 meters/second, so make sure to test your device for high winds!

Turbine Performance Testing

- All teams will be given time to tweak and test their turbine before the actual testing begins (using our practice wind tunnel).
- Each team's testing session will last ten minutes (may change slightly depending on each region's schedule). Teams can perform as many one-minute data collection periods (i.e., "runs") as desired during those ten minutes and make adjustments as needed.
- In the event of a catastrophic failure, teams will have a chance to try again at the end of the day (if there is sufficient time). We will have a small repair station with limited supplies.
- To receive full points, the turbine must be able to start producing power (turning) on its own without external assistance (e.g., students cannot give it a push to get it started).
- Once the team is ready (turbine is in the tunnel and connected to the data collection system), the wind tunnel coordinator will turn on the fans. Once the turbine has reached its "peak," the team will signal to begin collecting data. Once data collection has started, wind tunnel coordinators will not stop the run until the one-minute testing period is complete (barring catastrophic failure).
- If a turbine produces so much power that it damages the generator before testing is complete, the team will be able to retest its turbine as long as it can repair its generator. The Kansas Energy Program will have a limited number of spare generators available. If coordinators are unable to

record power and energy data with our equipment due to generators overheating, the turbine may not receive a power and energy score.
- The best one-minute performance period will be used for scoring.
- Local judges have final say on rulings and disputes.

Scoring

- Each team will receive a score (out of 100) based on turbine performance (45 points), judging and documentation (40 points), and knowledge quiz (15 points).
- *Turbine performance (45 points)*
    - The best one-minute performance period will be used for scoring.
    - Turbines will be ranked by energy output. The highest producing turbine will receive the full number of available energy points, the following turbines will receive points based on rank with a two to five-point deduction for each position they are from the top turbine (this deduction will depend upon number of teams).
    - We will likely base five of the 45 turbine performance points on efficiency, which is the amount of power produced based on turbine size and wind speed.
- *Judging and documentation (40 points)*
    - A panel of three judges will meet with each team for 10-15 minutes.
    - Parents and coaches will not be allowed in the judges' room.
    - Students should produce some type of documentation that reflects their design process and their knowledge of wind energy science. It is up to each team to determine how they want to document this part of their project. This documentation could take the form of a short report, a PowerPoint presentation, notebooks, poster boards, or anything else that effectively communicates their design process. If students need a piece of equipment for their presentation (e.g., a laptop for a PowerPoint presentation), we can coordinate with you and try to accommodate.
    - This interview is to get a better understanding of the process the team went through as it designed and tested its turbine. Each team should be prepared to discuss/defend the choices incorporated into the design.
    - At each challenge, there will be four to five judges who rotate in and out of the interview process; there will always be three judges conducting the interviews. Our goal by rotating judges is to allow them to have breaks. This should help the judges to be more engaged with each of the teams and provide better feedback and a more positive experience for the students. The judges will all meet prior to the competition to discuss the scoring criteria to ensure they are on the same page.
    - An example of the judging scoresheet is available at www.kansasenergyprogram.org/kidwindchallenge.
- *Knowledge quiz (15 points)*
    - Each team will complete a knowledge quiz consisting of 15 questions (one point each). Questions are multiple choice, matching, etc. (i.e., not open-ended).
    - Each team will work together to complete the quiz within 15 minutes.
    - Both divisions will have approximately ten similar questions. The questions that differ will have more appropriate difficulty levels for each respective division.
    - The resources used for the quiz questions are posted online at www.kansasenergyprogram.org/kidwindchallenge. Some questions are considered general knowledge of wind turbines and wind energy and may not be included under the posted resources.