



10th Annual Model Wind Turbine Competition

WIND POWER is the fastest growing energy source in the world. In 2006, the total installed wind power capacity worldwide reached 74.2 gigawatts (GW), which represented a massive increase over the previous decade.¹ Although a relative newcomer to wind farm development, Canada's energy industry has grown rapidly since 2000, with installed capacity increasing by an average of 51% annually. Canada's current installed capacity is 1,492 megawatts (MW).²



The Province of Manitoba invested in a 99MW wind farm at St. Leon in 2005, which resulted in the installation of 63 wind turbine generators which have sufficient power to serve approximately 35,000 homes. The province plans to develop 1,000 MW of wind power over the next decade and to invest up to \$2 billion in the industry.



Pattern Energy Group commissioned the \$345 million St. Joseph Wind farm in March of 2011. The 138 megawatt (MW) project consists of 60, Siemens turbines, each with a nameplate capacity of 2.3 MW. The turbines are set on towers that are 80 metres high and will generate enough power to serve the needs of 50,000 homes. The project is distributed over an area of 125 square kilometres (over 30,000 acres) of privately owned agricultural land and is located in the rural municipalities of Montcalm and Rhineland.



Accordingly, Skills Canada Manitoba (SCM), the Certified Technicians and Technologist Association of Manitoba (CTTAM) and Red River College (RRC) have collaborated to establish a competition focused on wind energy. Grade 9 and 10 students across Manitoba have an opportunity to use their knowledge, skills, leadership, teamwork and ingenuity to design and build a working model wind turbine in a one-day competition during National Trades and Technology Week, which runs from October 31 – Nov. 4, 2016.

The essential details for the competition are:

- Tuesday, November 1, 2016
- 9:00 a.m.– 2:45 p.m.
- Red River College
Notre Dame Campus
South Gymnasium

¹ Global Wind 2005 Report, <http://gwec.net>

² Canadian Wind Energy Association, <http://www.canwea.ca>

The Challenge

Four Grade 9 or Grade 10 students from the same school will design and construct a working model wind turbine. The students will be given specific materials to construct the wind turbine and will have approximately **2 hours** of building time at the competition site. However, teams may not pre-construct a model wind turbine to use during the competition.

The model wind turbine will need to be solidly constructed and able to generate electrical power, which will be measured. Wind simulation will be created by a fan situated at a measured distance from the wind turbine being tested.

Model wind turbines will be judged in three categories: (a) design; (b) construction; and (c) voltage-generating capacity. Each wind turbine design and construction will be judged by a panel of expert judges. Turbine voltage-generating capacity will be measured electronically and competitively in a progressive play down. Three trophies will be awarded—one for each category.

Teachers:

Teacher advisors are allowed to provide guidance and advice **before** the competition starts and during one 15-minute break. The challenge is designed to test problem-solving skills and involves a broad base of curriculum including:

- Turbine and blade design research
- Wind power/energy and geographical constraints
- Electricity generation theory and practice
- Construction principles: structure and strength
- Adhesives and bonding
- Leadership
- Teamwork
- Time management

Eligibility

A maximum of **sixteen** (16) teams can be accommodated for this competition.

- Schools may enter **one** (1) **mixed** team of four Grade 9 or Grade 10 students each. If there are not 16 entries from different schools by the deadline, a second team may be entered.
- Team registration is on a first-come, first-serve basis.
- Each team must have one teacher/advisor.
- Teams must comprise students from the same school.
- Teams must be mixed teams (at least **one** person on the team must be of the opposite gender).
- Completed Registration forms are required by 4:00 p.m. on **October 18, 2016**. These may be faxed or mailed to (204) 927 – 0258 (Fax) or Skills Canada Manitoba 31 – 1313 Border Street, Winnipeg, MB R3H 0X4 (Mail).

Specifications

- Each team will choose a team name to be included on the Registration form.
- Each team will be assigned a team number for the duration of the competition.

Tools and Materials:

These will be supplied by the sponsors:

<u>Item</u>	<u>Quantity</u>
• Small DC motor with mounted LED.....	1
• Poster board, 22" x 28" (55.9 cm x 71.1 cm), sheets	4
• Balsa wood, 4" x 36" x 1/8" (10.2 cm x 91.4 cm x .32 cm), sheet	1
• Balsa wood, 4" x 36" x 1/16" (10.2 cm x 91.4 cm x .16 cm), sheet	1
• Particle board base, 12" x 12" x 5/8" (30.5 cm x 30.5 cm x 1.58 cm), piece ..	1
• Tape, masking, roll	1
• Adhesive, tube.....	1
• Wood, circles for propeller hubs, 1.75" (4.45 cm) diameter	3
~ One Slotted at 30 degrees, 4-blade	
~ One Slotted at 30 degrees, 8-blade	
~ One Blank	
• Utility knife, retractable.....	1
• Scissors, pair	1
• Geometry set	1
• Pencils	

- Sandpaper

(Note: No other tools or materials will be allowed in the construction of the model wind turbine.)

Design and Construction Rules and Regulations

1. Each team must bring TWO COPIES of the model wind turbine design sketch or blueprint.
2. The design must show evidence of originality and not just be something captured from a website.
3. The quality of the sketch or blueprint will be an evaluation factor.
4. Students will receive the standard list of materials and equipment on competition day and construct the project for judging in the afternoon.
5. Students may use the supplied material in whatever manner they see fit to achieve their design.
6. Teams may choose to appoint a Team Leader, but teamwork, participation by all team members, and time management will be evaluated.

Judging Criteria

Design

1. Evidence of originality
2. Quality of wind turbine sketch or blueprint
3. Appropriately-labelled components

Construction

1. Adherence to design
2. Structural soundness
3. Economic use of materials
4. Quality of construction
5. Leadership, participation and teamwork

Power (Voltage Generation)

1. Highest voltage generated under test conditions.
2. Where a tie occurs, the quality of construction will be judged as the tie breaker.

Voltage Generation Test Procedure

1. The model wind turbine is positioned on a 3' x 8' table, 36" from a three-speed, 20" high velocity fan. Manual support or touching of the turbine during the test period is **not** allowed. Weights will be provided to prevent the base from sliding.
2. A digital voltmeter is attached across the load device.

3. The fan is turned on and stepped through the three speeds of approximately 12, 16 and 22 kilometres per hour in 20 second intervals.
4. The highest voltage reading at each speed is recorded. The highest aggregate score at the three speeds will win the category.
5. The model wind turbine must survive the entire one-minute test intact to be eligible to win in this category.
6. There will be a play down among the teams to determine the ultimate winner in this category.

On the Competition Day

1. Team members should expect to arrive at the Red River College South Gym, Notre Dame Campus, between **9:00 a.m. – 9:30 a.m.** on competition day (November 1, 2016).
2. Lunch will be provided by Skills Canada Manitoba for student participants and one advisor. If students feel they require additional sustenance, it is recommended they bring it with them (e.g. granola bars, fruit, juice boxes, etc.).
3. Evaluation forms will be provided to all participating schools upon arrival and registration in the information package.

Schedule for the Day

<u>Time</u>	<u>Activity</u>
9:00 – 9:30 a.m.	Arrivals and Registration
9:30 – 9:45 a.m.	Announcements and Instructions
9:45 – 10:45 a.m.	Turbine construction
10:45 – 11:00 a.m.	Break – <i>Advisors may meet with team</i>
11:00 – Noon	Turbine construction
Noon – 12:45 p.m.	Lunch (Provided)/Guest Speaker(12:15 – 12:45)
12:45 – 1:15 p.m.	Final Touch-Ups/Turbine Design and Construction Judging
1:15 – 2:20 p.m.(approx.)	Voltage Generation competition play down
2:20 – 2:35 p.m.(approx.)	Awards presentations

Awards

- **Best Design** – Skills Manitoba Trophy
- **Best Construction** – Certified Technicians and Technologists Association of Manitoba (CTTAM) Trophy
- **Highest Voltage** – Red River College Trophy

For additional information contact:

Skills Canada Manitoba

(204) 927-0250 or lorir@skillscanada.com