WindLab, WindCharge and **WindPitch** are mini wind turbine (wind power generator) designed for students to learn the Wind Power Technology. You can do various experiments with it to understand how a wind turbine works to generate electricity.

Blades on WindLab and WindCharge are made of Polypropylene sheet, while WindLab Plus, WindCharge Plus and WindPitch include Polypropylene Sheet Blades and molded Profile Blades.

Students can modify the parameters of these turbines to see how the output changes at different wind speed conditions. The vane on the turbine aligns the turbine automatically to the direction of wind.

The output power of WindLab Plus, WindCharge Plus and WindPitch are much higher than that of the WindLab and WindCharge because of the profiled blades and optimum Blade Pitch.

The special 3 Phase AC Alternator used in the turbine is similar to the one used in real commercial wind turbine.

When wind speed is above the Start-up speed, electricity is generated from the wind turbine. LED inside the WindLab turbine lights up to indicate electricity is generated. The generated electricity can also be stored in the Gold Capacitor inside the turbine. Switches are used to direct the electricity generated from the turbine to this storage capacitor or to the output connector.

You may use a floor fan as the wind source for doing experiments with this turbine. You may then adjust the wind speed switch settings on the fan and the distance to see the performance of the turbine under this controlled environment. This is something that you cannot control when you are evaluating the performance of a roof-top wind turbine.

With the help of some accessories, like the Light and Music Module (LM-1) and the Visual Voltmeter, (VM-1), the Energy Monitor (EM-1) and Resistive Load, you can demonstrate the following experiments with the turbine easily:

Energy Monitor (EM-1) is a great tool for doing experiments

1. How much wind is required to start the wind turbine at different conditions
2. The wind is never steady (with the Visual Voltmeter and Energy Monitor)
3. The wind direction changes all the time
4. The vane aligns the turbine towards the wind (take away the vane?)
5. The output voltage is highest when the turbine faces the wind
6. How many blades and what pitch angle are best for start up
7. How many blades is more efficient at low and high wind speed
8. What is the optimum blade pitch at low and high wind speed
9. The output voltage is proportional to the wind speed
10. Wind Power is proportional to the cube of the wind speed
11. The rotation speed of the turbine is proportional to the wind speed
12. Rotation speed of turbine reduces when load is connected
13. There are noises and vibrations when the turbine operates
14. How generated electricity can be stored (in Gold Capacitor and rechargeable battery)
15. Demonstrate that the stored electricity can be used (with the Light and Music Module)
16. You may connect different electrical loads, e.g. DC motor, resistors, capacitors, light bulbs
17. You may also integrate the turbine with solar panel to see how they complement each other in real situations (with Solar Panel and Energy Station) to charge rechargeable batteries
18. You may test the Wind Farm concept to see how the output power of different wind turbines is affected when they are connected in parallel or in series
19. You may change the blade and vane parameters to see the output changes under different wind speed conditions
20. Is the vane effective and what is the shape and minimum size to be effective

21. You may use computer learning systems to record and analyze the performance of the turbine for further learning

3-Phase AC Alternator

WindLab can generate electricity at low wind speed. It operates on a small 3-Phase AC Alternator (motor generator). The AC electricity is rectified to DC electricity which can be stored in the Gold Capacitor inside the turbine or sent to the output connector directly. 3-Phase Alternators are more powerful than DC motor generators. The life time of 3-Phase motor generators is much longer because they do not have copper brush contacts (commutator) that wear with time.

Blade and Vane Modification

Blades are important components that need to be matched with the wind speed environment in order to maximize the efficiency of a turbine. At low wind speed, more blades will be better and the blades should be long and wide. At high wind speed, the blades should be short and thin. The number of blades is also an important parameter of a wind turbine. You may install 1 to 6 blades on the WindLab to see the effects, even if the blades are not balanced symmetrically. However, it is difficult to test these parameters on a real wind turbine. Even if you can change the blade parameters on a real wind turbine, you cannot command the speed of the natural wind for you to test the result.

WindLab allows you to evaluate these parameters easily. It comes with a set of 3 blades and 1 vane, which are cut from flexible plastic (Poly-Propylene) sheets, for you to start with. The design concept is to let you design your own blades and vanes with easily available plastic or paper card sheets. Scissors and Punch are the standard stationery needed to work with your knowledge and imagination to create your own blades and vanes. You can modify the number, size and shape of the blades to see how the output is affected at different wind speed. You may also modify the size, shape and color of the vanes to make fun with it.

Pluggable Rotor Application

The pluggable rotor allows you to install and uninstall the rotor to the turbine body easily. This is a great improvement to the previous version. With this Pluggable Rotor, you can also pre-assemble several rotor assemblies with different sizes of blades for quick changes to the turbine. The changes in the output can then be observed in turn immediately under the same wind condition. The students will understand what parameters of blades are critical in harvesting the wind energy at that particular wind speed.

Wind Farm

You may connect several wind turbines together to form a Wind Farm. You will learn how to configure the wind turbines to increase the output voltage or current by connecting them in Series or Parallel. In real situation, the wind speeds encountered by different turbines in the wind farm are different. The energy reception of each wind turbine is different and its output voltage and current are different. You will notice how the final output is affected when the outputs of these turbines are different.

Output Voltage Indication

You may use our Visual Voltmeter (VM-1), to observe the output of the wind turbine. The higher the voltage, the higher is the output power.

Specification of WindLab:

Power Capacity (@ Rotor speed of 2000 RPM)	:- 1W
DC Output Voltage (@ Rotor Speed of 2000 RPM)	:- 10V
DC Output Current (@ Rotor Speed of 2000 RPM)	:- 100 mA
DC Output Voltage (@ Rotor Speed of 1000 RPM)	:- 5V
DC Output Current (@ Rotor Speed of 1000 RPM)	:- 50 mA
Start-Up (Rotor start to turn) Wind Speed	:- 3.5 mph (1.6 m/s)
Cut-In (Generator starts to generate electricity) Wind Speed	:- 5 mph (2.2 m/s)
Length of WindLab	:- 200 mm
Height of WindLab (Centre of rotor to Base)	:- 230 mm
Poly-propylene sheet Blade sweep radius	:- 155 mm

Schematic Diagram:

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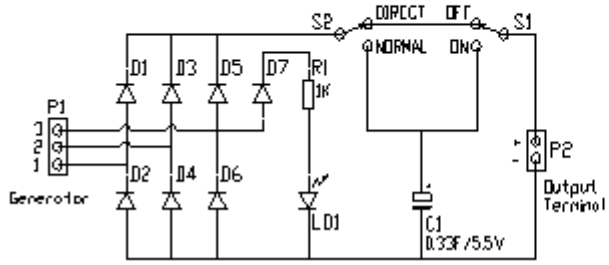
WindLab



WindCharge and WindPitch