

## **Windmill Building**

Supplied materials:      Motor  
   Bushing  
   Pulley  
   Motor Mount  
   Leads

## **Tower Construction**

Students will need to build a tower to hold the motor and blades. Popsicle sticks and glue are cheap and suitable materials. Plastic pipe is fairly cheap.

### **Considerations**

1.      The box fan is about 30" high, so they will want to hold the motor somewhere in the middle of this height.
2.      The tower should not block a lot of air flow as this will cause turbulence. The tower should be a frame structure; not with solid sides. This is especially important behind the motor and blades.
3.      The tower will need to be stable and not blow over. It could be attached to a sheet of cardboard on the bottom.

## **Blade Construction**

Blades need to be attached to the pulley. Cardstock or box board from cereal boxes are cheap and light. Styrofoam could also be used, especially if students want to try to sculpt the blade.

## **Considerations**

### 1. Blade Number

For large windmills, three blades have proven to be the most effective in higher winds. This does not necessarily mean three blades is the best for this scaled down model, but it seems likely as the box fan produces a high airflow in proportion. Two or four bladed models may be easier to balance (see point 2 below), and I have seen some great six bladed models.

### 2. Balance

It's important for the blades should be as balanced as possible. With no wind, students should be able to give the blades a very light spin and have the motor continue spinning for a while.

### 3. Blade Angle

The best blade angle for large wind turbines is only 5 to 10 degrees. This does depend on a lot of other factors, so students should try different angles.

### 4. Blade Shape

Blades are normally smaller towards the tips to keep the turbine stable. Blades from commercial turbines are shaped like an airplane wing, but this is difficult to accomplish with a scale model such as this.

Students will likely need to try different widths and lengths of blades.

