



## HANDS-ON ACTIVITY

# 2.4.2 Research the Science

## Quick Look

**Thread Concentrat... Green, Blue**

**Grade Level:** 9 (9-12)

**Expendable Cost/Group:** US \$0.00

**Activity Dependency:** None



What are the pros and cons of wind power and how is it harnessed?

## Educational Standards

➤ International Technology and Engineering Educators Association – Technology

## Materials and Cost

- **Materials**
  - computers with internet access for research purposes
- **Cost**

- o none

## Worksheets and Attachments

Lesson 2.4 Problem Definition Slide Deck

Activity 2.4.2 Wind turbine Research Student Handout

Visit [[www.teachengineering.org/activities/view/e4usa-unit2b-wind-activity4-2-research-science](https://www.teachengineering.org/activities/view/e4usa-unit2b-wind-activity4-2-research-science)] to print or download.

## Introduction/Motivation

Engineers follow a design process when solving a problem, rather than just guessing and checking. They rely upon their knowledge of science and math in order to make crucial design decisions. In this lesson, students will explore some of the science and math behind both wind power and turbines as well as clean energy.

## Procedure

### Before Class

- Select and prepare access to the research on wind power/energy and wind turbines. Note that all referenced sources in the procedure may or may not be at an appropriate level for students in your class.
- Decide if students will be allowed to access reference materials beyond the list that you provide.
- Prepare the student handout for recording research. This may be done electronically or on paper.
- Decide ahead of time if you will permit students to request and/or source additional materials for their wind turbine.
- Ensure that students have access to a computer (desktop or laptop).

### Procedure

1. [3 min] Show students the base model that they will all use for their wind turbines. Provide a list of or show them the materials you will make available for their turbines. Decide ahead of time and notify students if you will permit them to request and/or source additional materials.
2. [2 min] Introduce students to the task for this activity. Explain to students that their task is to gather and review relevant research about the science of wind power and wind turbines. Remind them that engineers do not guess and check. Instead

they rely on science and other fields to inform their design decisions and eventually the tests that they conduct.

3. [30 min] Select and provide student teams with scholarly articles and websites that they may review and take notes on about wind energy and wind turbines.

(Note that it is important for you to keep in mind that students may not understand the meaning of the term “scholarly resources.” Scholarly resources are usually based on a domain name for a university or organization as opposed to social media.)

(Note that many of these resources do not include prior turbine solutions, but are more general about harnessing wind. Some of these sources may be too difficult for your students to read and understand. It’s recommended to pre-review them and use the ones that are appropriate, even differentiating amongst your students as you see fit.)

- You may wish to encourage students to cite other sources, including ones that have example turbines in them, as well to cite their own past experiences designing turbines.
- Students may use the Activity 2.4.2 Wind Research Handout to record their research.
- Give students these general wind energy resources:
  - [How Do Wind Turbines Work?](#) By Office of Energy Efficiency and Renewable Energy
  - [Wind explained Types of wind turbines](#) by Energy Information Administration
  - [Types of Wind Turbines: The Quick and Easy Intro](#) by Linquip Technews
  - [All the benefits of wind power by Enel Green Power](#)
- Give students these scholarly manuscripts available on Google Scholar:
  - [Wind Power Generation and Wind Turbine Design](#) by Wei Tong
  - [Innovation in Wind Turbine Design](#) by Peter Jameison
- In Activity 2.2.2, students assembled the KidWind Kit in CAD. They may be interested in learning more about the science of that kit, including the science behind its generator, how gearing, blade count, blade angle, etc., impact the function of the kit.
  - Share the [Learn Wind](#) (Kidwind) resource for a comprehensive discussion of the KidWind kit’s science.

## Vocabulary/Definitions

**Turbine:** A rotary mechanical device that extracts energy from a fluid flow and converts it into useful work.

Wind Energy: A clean and renewable energy source.

## Assessment

None

## Engineering Design Process Portfolio

While students will not yet be writing anything in their EDP Portfolios, this information gathered would normally appear in Element B as well as in Element E.

## Supplemental Resources

- [KidWind Wind Turbine Basics for All Levels](#) (Vernier Science Education)
- [Designing the Perfect Wind Turbine](#) (Museum of Science)
- [How do Wind Turbines work?](#) (Lesics)
- [Types of Wind Turbines: 3 Main Types with Details](#) (Linquip)
- [Windwise Education](#) (Kidwind)
- [Learn Wind](#) (Kidwind)
- [Advanced Blade Design](#) (Kidwind)
- [Advanced Kidwind Experiment Kit](#) (Kidwind)

## Supporting Program

Engineering for US All (e4usa)

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