

Tackling the Technology Gender Gap Together: Wind Turbine Simulation

Level – Third Level

**Subject area/s – Technology - Computing Science
and Science**



Wind Turbine Simulation

Level - S2/3- 3rd Level

Subject area/s - Computing Science/Science 3rd Level (SCN 3-04b)

Experiences and Outcomes – Science and Technologies – Computing Science

SCN 3-04b - By investigating renewable energy sources and taking part in practical activities to harness them, I can discuss their benefits and potential problems

TCH 3-15a "I can select appropriate development tools to design, build, evaluate and refine computing solutions based on requirements"

Benchmarks – Technologies – Computing Science

- 1) Design and build a program using a visual language combining constructs and using multiple variables
- 2) Can find and correct errors in program logic
- 3) Writes code which receives and responds to real world input (in a visual language)

Duration of time – 4 x 50/55min

Computing Science Concepts and Approaches –

Algorithms

Debugging

Resources required

A computer

A web browser (Google Chrome recommended)

Internet access

Access to video - Simulating a wind turbine available on Glow or on [You Tube](#)

Overview of learning

Pupils will be creating a simulation of a wind turbine using real-world data and information from a wind farm in their area (if possible) in order to gain an appreciation of the variables involved and how changing them can affect the power generated.

A completed demonstration of the working simulation is available for teachers at:

<https://scratch.mit.edu/projects/148431571>

Multiple turbine simulation code available at:

<https://scratch.mit.edu/projects/149315143/>

Pupil Objectives

- I can simulate the movement of a single wind turbine
- I can create a program that simulates the power output of a single turbine
- I can explain the effect of increasing rotor area and wind velocity has on power output
- I can simulate a wind farm with multiple turbines
- I can get my program to calculate the total power output from multiple turbines

Introduction

Using the attached presentation:

15 minute discussion of wind farms in your pupils' area.

Slide 4 - Get pupils to make a short list of what they think are the variables involved that affect power output from a wind turbine. (slide 4)

Teachers may want to briefly explain about air density and efficiency rating before starting. On the board, show an example of turbine data in your area. Usually this can be found in online planning applications. If you can't find any information then use this:
<http://bit.ly/2IT3jf5>

Main Activity

Slide 5 - You can either get pupils to find out information on a wind farm in your area or use the data provided in the associated presentation. Assign up to 30 minutes to find this information.

You can find the names of wind farms here:
<http://ukdataexplorer.com/renewables/>

Pupils can then search online for associated data around the wind farm name.

Once finished research

Pupils will use Scratch to develop a working simulation of a wind turbine. Using the video tutorial provided, pupils should work through it, using variables from a turbine in their area (if possible).

The video entitled **"Simulating a Wind Turbine"** (within the lesson folder) can be followed by the students all the way through until completion

Note, pupils should firstly go to <https://scratch.mit.edu/> and create an account by clicking "Join Scratch". This allows them to save their projects.

Once finished:

Slide 6

Using the wind farm data, get pupils to multiply their maximum output with the number of turbines. The wind farm's "rated output" (at <http://ukdataexplorer.com/renewables/>) should match, confirming their simulation is working correctly.

Plenary

As everyone's design will be different, get pupils to showcase their turbines to class members.

Differentiation

For pupils struggling to follow the concepts of this lesson, they can be encouraged to simulate a wind farm by having multiple turbines that react to changes in wind velocity.

For pupils requiring extra challenge, they can be encouraged to include multiple turbines and add their output together to give a total output for the wind farm. If you're basing it on a real-world wind farm, your total simulated output should match the rated output listed online.

Assessment Opportunities

TCH 3-15a

Benchmark 1) Ask the pupils to explain the purpose of the "forever" loop to cover

Benchmark 1) If they've used multiple variables

Benchmark 2) Debugging can be observed throughout the activity

Benchmark 3) Finished working program is evidence for this.

Extra challenge for those who are simulating multiple turbines. No instruction is given for this but an example of the code is available at:

<https://scratch.mit.edu/projects/149315143/>

If students need some hints as to how about introducing multiple turbines, encourage them to create a "number of turbines" variable and multiply their power output by number of turbines.