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Wind Blade Design Science Inquiry Project

Introduction

Generating energy from wind is something that has been used since antiquity. In the past wind wills were used to power sawmills, and mill grain. Today we recognize that harnessing power from the **wind is a renewable resource** that is clean and does not produce carbon dioxide emissions. As the climate crisis intensives around the world, it is imperative to find other methods to produce power that does produce carbon dioxide.

Figure 1: Wind turbines in a field – adobe stock images

In New Brunswick, wind power is quickly becoming an important part of the province's energy grid. Many of these projects are in partnership with First nations. The province currently has seven wind farms operating:

Wind Farm	Operator	Megawatts produced (MW)
Burchchill Wind Project	Natural Forces / Neqotkuk Maliseet Nation / Saint John Energy	42
Caribou Wind Park	ENGIE / NB Power	99
Lamèque Wind Farm	Acconia Energy / NB Power	45
Kent Hills Wind Farm	Transalta / Natural Forces / NB Power	96
Wisokolamson Energy Project	SWEB Development / Woodstock First Nation / NB Power	18
Wocawson Energy Project	Natural Forces / Tobique First Nation / NB Power	20
Oinpegitjoig (Richibucto) Wind Project	Natural Forces / Pabineau First Nation/ NB Power	3.8
Cap-Pelé Wind	WKB Community / NB Power	2.35

Wind Blade Design Science Inquiry Project

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When selecting a location for a wind farm, it is important to select a site that has enough wind to generate the most amount of energy. Below you will see a map of New Brunswick's windiest places. Not surprisingly many of the wind farms have been built in these locations.

Selecting an appropriate site is just one concern for generating the most wind energy. Wind turbines work by using **wind blades** that capture the wind to spin a turbine to produce electricity. There are many wind turbine designs, and **your task is to use the materials presented to make a wind blade design that produces the most amount of energy possible**.

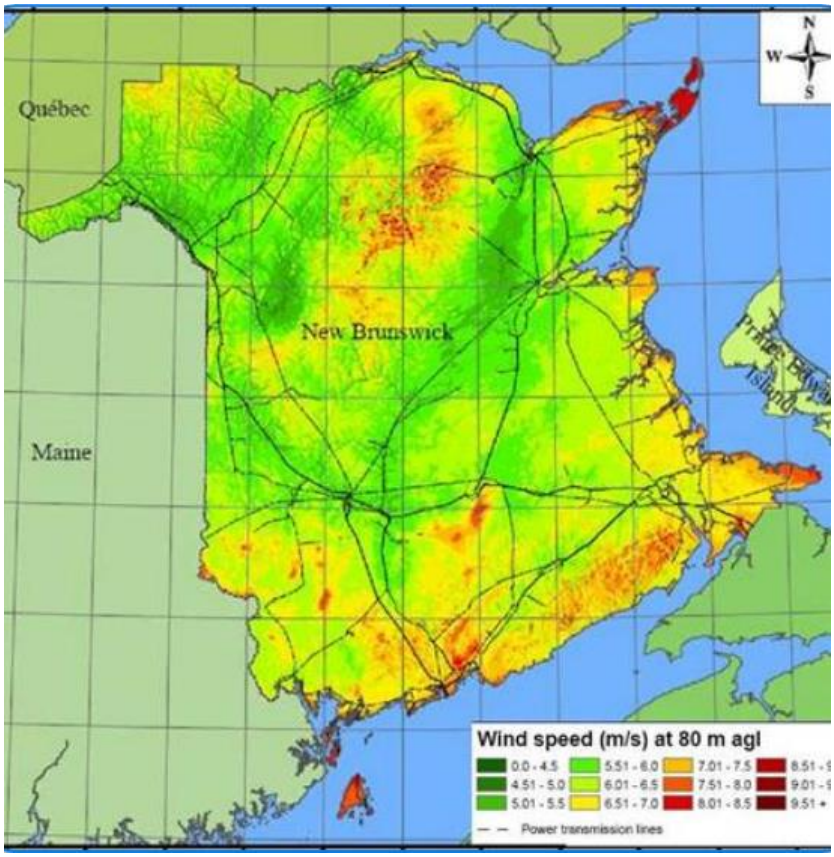

Figure 2: New Brunswick Wind Atlas – Government of New Brunswick

For this project you can choose one variable to manipulate: **Blade Shape, Blade Material, Blade Angle (Pitch), Number of Blades, Blade Size**. Just remember to select only one and control for all the others.

The first thing you should do is to research what designs work best. Here are some sites and videos that will help you with your research, but please find your own as well:

https://renewablesnb.ca/case-studies/wind/#:~:text=Wind%20power%20generates%20432%2C400%20MW,that%20is%20within%20New%20Brunswick.

https://www.youtube.com/watch?v=pBFCIxZfQ4s&t=12s

https://www.alternative-energy-tutorials.com/wind-energy/wind-turbine-blade-design.html

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Step 1: Observing & Questioning

What did you find in your **research**?

What will be your **Inquiry Question**:

Draw a **labelled diagram** of your design or experimental set-up:

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Step 2: What will I change?

One variable I will change:

I will measure or observe this result:

What will I not change? (List all the variables that will stay the same):

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Step 3: What can I measure or observe?

What variable will be your **Independent Variable**? (think about what you are changing)

What variable will be your **Dependent Variable**? (think about what you are trying to measure)

What are some variables that could affect the what you're trying to measure or observe (**Controlled Variables**)?

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Step 4: What is my hypothesis?

If the _____ is _____

Independent variable

How will the independent variable change?

Then the _____ will _____

Dependent variable

How will the dependent variable be affected

I think this will happen because....

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Step 5: Planning your experiment

How will you measure or observe your **Independent Variable**?

How will you measure or observe your **Dependent Variable**?

What materials do you need to conduct your experiment?

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Step 6: How will you do your experiment?

Write down a **procedure** for your experiment. This should be exactly what you will do so that someone else could perform the experiment the same way.

Congratulations! At this point you should be ready to conduct your experiment. Please do so with teacher supervision and make sure to record any observations or measurements.

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Step 7: Gathering Data

Gather your data and record it in a table format. Depending on what you chose to measure your data table may look different from other classmates.

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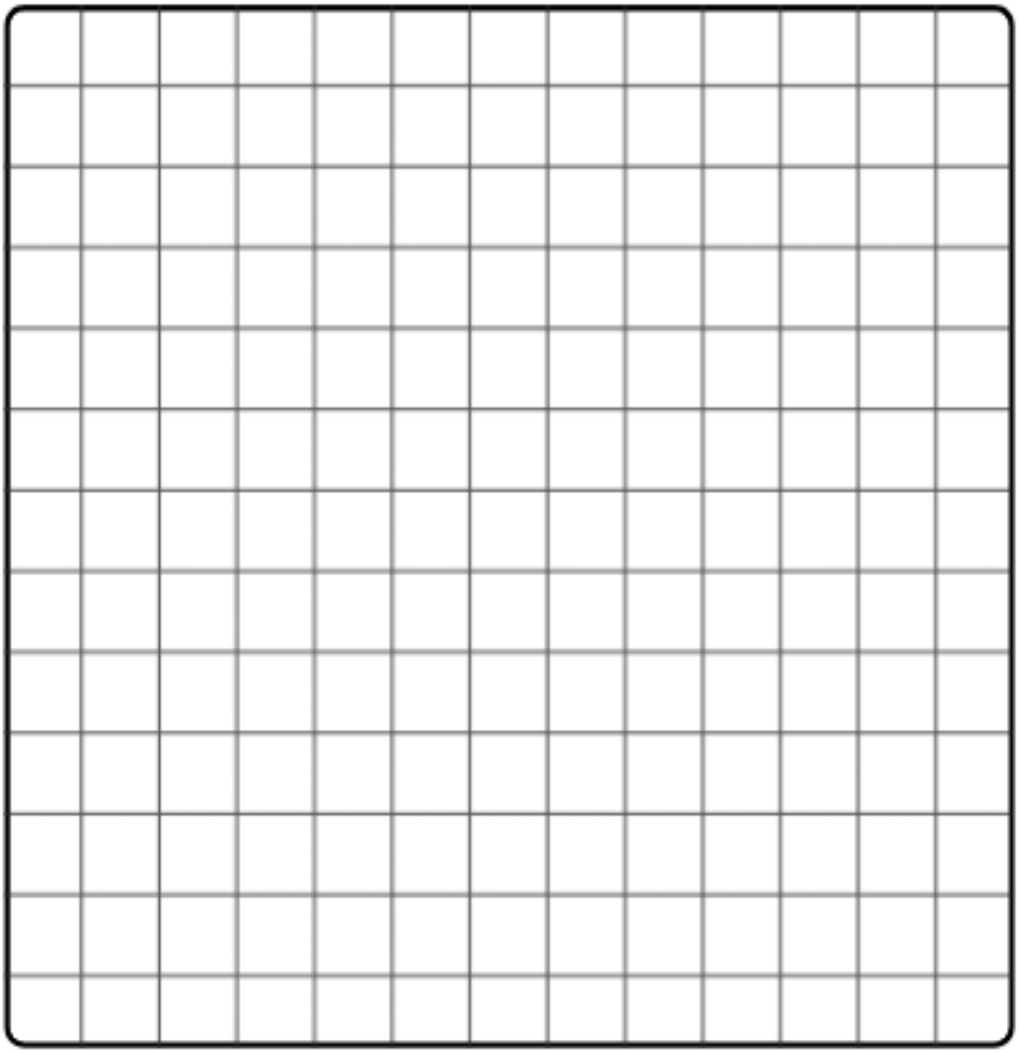
Step 8: Graphing your data

Use the graph paper below to graph your data. Make sure to use consistent spacing and pick an appropriate graph for your data (scatter plot graph, bar graph, etc.). Make sure to include a title and label your axis with units where applicable.



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Step 9: Analyzing your results

Looking at your data and graph, what do you notice about your results?

Was your hypothesis correct given your results? Why or why not??

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Step 10: Evaluating your results

What errors were made during your experiment? How could they have been corrected for?

If you were to conduct this experiment again, what would you change? Would you measure something different?

What implications does this have for Wind Blade design?

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References

- Smarter Science Framework
  - (For Educators - Youth Science Canada | Youth Science Canada)
- NB Power
  - Wind Energy (nbpower.com)
- Government of New Brunswick
  - The New Brunswick Wind Atlas (gnb.ca)
- Kidwind
  - KidWind — Teaching the World about Renewables