eCards

Research Topic
Wind Energy

Wind Energy

We all know about the wind and its effects, from the gentle swaying of a tree to the commotion of a stormy night. But did you know that the wind can be harnessed to produce electrical power for everything from a single house to an entire city? Humans have used the wind for thousands of years for tasks such as pumping water and sailing. The term "windmill" came into usage as mills used the wind to grind grain.

About 120 years ago, people started to use the wind to generate electricity. Today, wind power is one of the most popular renewable energies. In Canada, wind already supplies 3.5% of all our energy (Natural Resources Canada, 2017). While small windmills are still common on farms for pumping water, some farms now have wind turbines, large wind-powered machines that generate electricity. There are also 317 wind farms in Canada, collections of turbines that generate electricity for the electrical grid (Airswift, 2022). Where is a wind turbine or wind farm near you?

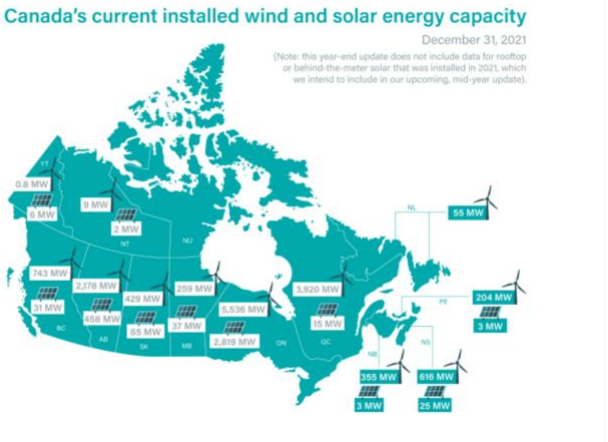

Image Source – (Canadian Renewable Energy Association, 2021)

How Does Wind Become Energy For Human Use?

The wind is created when the unequal heating of the earth's surface causes heat to rise in certain places and cooler air to flow into the spaces left behind. Because the heating of the earth's surface will always create wind, the wind is considered a renewable energy source. Wind power is created when we use the force of the wind to generate electricity using a wind turbine. If there is enough wind in a certain area, wind turbines can be put up and electricity can be generated.

A wind turbine is connected to the electricity system called the "grid." The electricity grid distributes power to homes, schools, farms and businesses.

The generation of wind power can be large-scale or small-scale. Large-scale wind generation provides electricity to the electrical grid just as coal, hydro or natural gas electrical generation facilities provide electricity. A single large-scale wind turbine produces enough electricity to power hundreds of homes. Clustered together on a "wind farm," turbines can produce enough electricity for thousands of homes and businesses!

Small-scale wind turbines provide local, on-site electricity to a single home or business, or to remote off-grid locations. Small wind turbines are set up where electricity is needed. Any additional electricity generated by the turbine, electricity that is not needed by the home or business owner, can be sent to the local electrical grid.

What are the Advantages and Disadvantages of Wind Energy?

Like all energy sources, wind power has both advantages and disadvantages.

Advantages:

- Wind comes at no charge: it is a free source of energy.
- Wind power costs can be similar to other traditional sources of electricity.
- Wind is a renewable energy resource.
- Wind turbines do not cause air pollution.
- Small-scale wind turbines can be used in areas that are hard to access with the electrical grid.
- Wind power can be used in connection with other renewable energy resources such as hydro energy.
- Wind power reduces our contribution to climate change.

Disadvantages:

- Wind turbines need to be built in areas where the wind is strong and reliable.
- When wind speed is too fast or too slow, electricity is not produced.
- The wind does not blow all the time.
- Because wind turbines are very tall, wind farms change the appearance of an area.
- Wind turbines are expensive to purchase and install.
- Small wind turbines sometimes require energy storage devices such as batteries.

There has been some concern about the impact of wind turbines on wildlife such as birds. Because birds can be harmed or killed if they fly into the blade of a wind turbine, some people believe that wind power should not be used. When we think of this problem in isolation, it does make us question whether wind turbines are a good choice.

When we think of the bigger picture, however, we are better able to weigh and measure the risk. Wind power is not unique in its impact on birds: consider the harm done to birds by non-renewable energy sources (e.g., from mining operations that remove all wildlife habitat), by human structures such as large downtown office buildings or the bay windows in houses, or even by domestic cats.

Can Wind Power Help Meet Canada's Needs?

Wind power is efficient and clean and its energy source, the wind, costs nothing. As the cost of generating electricity increases and people worry more and more about the effects of climate change, wind power is becoming increasingly appealing. Although wind power cannot completely replace all other sources of power, it is one important way for us to reduce our dependence on fossil fuels like oil and natural gas.

Currently, Canada is behind many other developed countries in how much electricity we produce from wind, but the industry is rapidly growing in many parts of the country. Experts can now help families, farmers, businesses and even cities decide whether the wind is the right choice for them.

How Does a Wind Turbine Work?

To better understand how a wind turbine works use GreenLearning's wind turbine simulator here: https://programs.greenlearning.ca/course/wind-turbine-simulator

By clicking through the simulator, you can see how things like wind direction affect energy output.

Global Facts

- Worldwide wind capacity reaches 744 Gigawatts, an unprecedented 93 Gigawatts added in 2020. (REVE, 2021)
- The biggest producers of wind energy as of 2021 are China (221 GW), United States (96.4 GW), Germany (59.3 GW), India (35 GW), and Spain (23 GW). (REVE, 2021)
- According to the 2022 Global Wind Report 21.1 GW of offshore wind capacity was commissioned in 2021. (Global Wind Energy Council, 2022)

Canadian Facts

- In 2020, Canada ranked 9th in the world for installed wind energy capacity. (Canadian Renewable Energy Association, 2021)
- At the end of 2021, Canada had approximately 14,304 MW of installed wind energy capacity. (Canadian Renewable Energy Association, 2021)
- More wind energy has been built in Canada between 2009 and 2019 than any other form of electricity generation. (Canadian Renewable Energy Association, 2021)

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