Gr 7 Wind Energy

**Prompt: Explain one way in which technology can mitigate the impact of increases in human population and per capita consumption of natural resources.**

<https://www.youtube.com/watch?v=SQpbTTGe_gk>

*Excerpted from Wind Energy:Facts*

<http://www.mass.gov/eea/energy-utilities-clean-tech/renewable-energy/wind/wind-energy-facts.html>

**What would meeting the Governor's wind goal of 2,000 MW by 2020 mean?**

It would reduce our dependence on fossil fuels such as coal and natural gas for electricity generation, reduce our greenhouse gas emissions, and create economic development and green jobs. 2,000 MW of wind on land and offshore would:

* Generate enough electricity to power over 800,000 homes
* Meet 10 percent of the state's electricity load with clean, renewable energy
* Reduce the state's greenhouse gas emissions by roughly 12 percent, or approximately 3.1 million tons

**How many homes can a wind turbine power?**

A single 1 MW turbine on land can provide enough electricity to power 225 to 300 households. A single 1 MW turbine in an offshore wind farm, where the wind blows harder and more consistently, can power more than 400 households,.

**How much carbon dioxide does a wind energy turbine offset?**

1 MW of wind energy can offset approximately 2,600 tons of carbon dioxide annually.

**What is a capacity factor and what does it mean for wind power?**

Capacity factor describes the relationship between how much energy an electricity generator actually produces compared with how much the generator could produce if it was in constant operation at maximum capacity. Capacity factor is usually expressed as a percent (actual generation/potential generation). Conventional generators usually burn fuel , so they can run around the clock, and are generally limited in production only by down time for maintenance, so their capacity factors range from 40 to 90 percent for

baseload power plants. Wind is an intermittent, or variable, energy source (i.e., wind energy turbines only

produce energy when the wind is blowing strongly enough). Capacity factors for wind energy usually range from 20 to 40 percent.

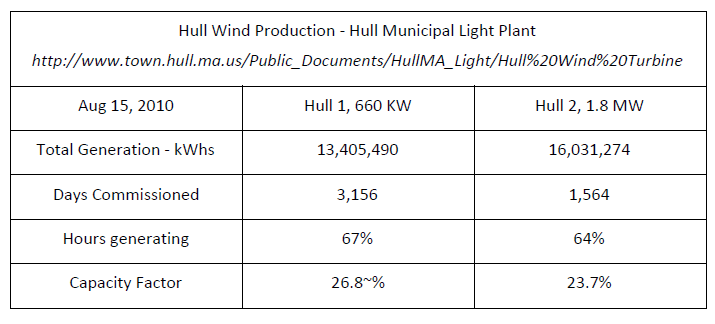
**How much wind energy potential is there in Massachusetts?**

Plenty. Wind energy, especially offshore wind, is one of the most abundant sources of renewable energy in Massachusetts. There are 1,500 MW of onshore technical potential in Massachusetts and slightly over 6,000 MW of offshore technical potential.

**Do wind turbines harm birds and bats?**

In certain circumstances, wind turbines can have adverse impacts on wildlife. Birds and bats may fly into the moving blades of a turbine, resulting in mortalities, but wind energy turbines are low on the list of threats to birds and bats. A 2007 National Academy of Sciences report in regards to the effects of wind energy on birds and bats found that existing wind turbines are not a threat to bird populations. Changes in habitat brought about by climate change, which is mitigated by replacing fossil fuel use with renewable power, are a significant threat to avian and bat populations.

Hull Wind Production - Hull Municipal Light Plant



*The Power of the Wind*

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A soft, rumbling hum vibrated in Kyle’s ears as he approached the farm. His mom walked in front of him, taking long, purposeful strides. Next to him, a group of curious visitors trotted in tow, listening to Kyle’s mom spout off facts. She was giving a tour of a wind turbine farm located in northern California in order to educate the public on the benefits of using wind energy. Kyle decided to tag along and learn something for himself. He knew only the basics about his mom’s profession, but was becoming more and more interested in alternative energy after living in Los Angeles for so long and experiencing the pollution and smog in the air.

“So there are three major types of wind power: utility-scale wind, distributed wind, and offshore wind,” his mom yelled to the group in an attempt to be heard over the hum of the turbines. “Here, we use utility-scale wind, in which turbines larger than 100 kilowatts generate electricity that is typically distributed by power system operators.” The visitors all nodded their heads, some taking notes. “When wind blows past the turbine, it triggers the movement of the blades, which starts to spin a shaft inside of the turbine, which then causes an attached generator to produce electricity,” she explained. She had studied both environmental science and engineering in college, so she understood how these turbines worked and the positive impact they had on the environment. She had been working at an environmental non-profit organization in Los Angeles before moving her family a few hours upstate in order to promote the wind turbine farm and its energy efficiency.

As Kyle’s mom continued to rattle off information about the turbines, Kyle’s mind drifted to his life in LA. He wasn’t too excited to leave his friends, but he couldn’t wait to move to “the country”—or at least that’s what everyone at school called it. They knew that he and his parents were moving to a farm, but not many knew exactly what a wind turbine farm was. All they could picture were those gigantic fan-looking machines that slowly rotated in the breeze.

They were right to an extent, since that was exactly what Kyle and the group were about to see. But since several families had moved closer to the farm to work with wind energy, there were plenty of kids whom Kyle could befriend. Their parents also worked with the turbines.

Finally, the group reached their destination. “Well, this is it!” said Kyle’s mom. At that point, the soft hum had increased to the sound of a loud lawnmower, and the visitors had to yell to each other to be heard. Everyone craned their necks back to look toward the top of the large turbines, each with three blades that slowly rotated with the wind. Kyle always imagined them moving faster, since they had to generate electricity, but his mom assured everyone that this was enough speed to produce adequate energy for the area. “In fact, California has the most utility-scale wind turbines in the United States, with more than 12,000 turbines,” she told the group. Everyone stood in silence for a while, admiring the tall, white machines rotating against the clear blue sky. Kyle breathed in the fresh air and closed his eyes, feeling perfectly content.

On the way back to the farm’s main office, Kyle’s mom told the group about her job and responsibilities. Since she specialized in engineering, she was particularly interested in the design of the wind turbine blades. She was heavily involved in research to design a blade that could more efficiently capture energy from the wind. After building a few prototypes, she and her team would test the blade in an air tunnel and measure the amount of energy it could produce. “Then we’ll make sure we can manufacture the most efficient model on a larger scale, and hopefully distribute them to farms across the country,” she explained.

Kyle knew plenty about this part of the job, mainly because his mom often missed dinners or left extremely early for work when she was in certain stages of designing. She would then come home and excitedly share her work with Kyle and his dad, who always listened patiently, even when they could hardly understand anything she was saying. That’s why they decided to move to the country—her passion for her work. When she was offered a job at the wind turbine farm, they packed up the car and drove north. Kyle remembered feeling the air change. As they drove further and further away from the city, he kept rolling his window down bit by bit.

After his friends, he missed LA food the most, and being able to walk out of his house at any hour of the day to find at least a food truck open for business. Out near the farm, there were only a few restaurants that offered meals that suited Kyle’s palate. But he could hardly complain when he spent the whole day outside, wandering among the vast fields and hiking new trails. Each day he returned home exhausted from the fresh air and the relentless sun. Since he was still on his summer break, the only opportunity he had to meet new friends was through his mom’s work. With school, he knew he would meet more. And maybe his old friends from the city would come visit, and see the beauty of the countryside—fields, wind turbines, fresh air, and all.

**Exemplar**

**Prompt: Explain one way in which technology can mitigate (reduce) the impact (effect) of increases in human population and consumption per capita (use per person) of natural resources.**

A technology **called turbines** can mitigate the impact of increases in human population and per capita consumption of natural resources because **people will need to use fewer natural resources.** Turbines produce energy from wind blowing past the turbine that triggers the movement of the blades. These blades start to spin a shaft inside of the turbine. This causes an attached generator to produce electricity. A single 1 MW turbine of an offshore wind farm can power over 400 homes. People depend on natural resources for electricity such as fossil fuels which include coal and gas. The human population is growing but these resources are not, so they will eventually run out. Power sources such as wind will never run out. If we use wind turbines to produce energy, then we will have energy sources that do not run out even if the human population keeps growing and per capita consumption increases.