

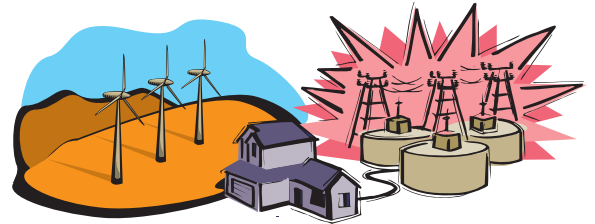
Problem

A single wind turbine generates about 2 megawatts of power, enough energy for about 500 homes. (You may assume that all wind turbines in this problem are similar and have similar production capabilities.)

- a) Total world electricity production by wind power in 2010 was 70 000 megawatts. How many wind turbines would have been needed to produce all of this by wind power?



- b) Some people predict that by 2050, wind power will generate about $\frac{1}{3}$ of the world's electricity needs. If world consumption did not change from 2006 (which is unlikely), when it was about 16 378.62 million megawatts, how much energy would be produced by wind power? How many wind turbines would be needed to generate that much electricity?



- c) In 2006, Canada's electricity consumption was 529.95 million megawatts for a population of about 30 million people, while the United State's consumption was about 3816.85 million megawatts for about 300 million people. Compare and contrast Canada's and the United States' electricity consumption.

Hints

Hint 1 - How many megawatts per person were used by Canadians in 2006? By Americans?

Solution

- a) Since one turbine produces 2 megawatts, to produce 70 000 megawatts would require $70000 \div 2 = 35000$ turbines.
- b) For wind power to generate $\frac{1}{3}$ of the 2006 consumption of 16 378.62 million megawatts, it would need to generate $16378.62 \div 3 \approx 5459.54$ million megawatts, or 5 459 540 000 megawatts. Thus, at 2 megawatts per turbine, this production level would require

$$5\,459\,540\,000 \div 2 = 2\,729\,770\,000$$

turbines, i.e., about 2.7 billion turbines, or about 1 turbine for every 3 people on earth!

- c) Canada's consumption of 529.95 million megawatts for 30 million people is about $529.92 \div 30 \approx 17.7$ megawatts per person. US consumption of 3 816.85 million megawatts for about 300 million people is about $3\,816.85 \div 300 \approx 12.7$ megawatts per person. Thus Canadian consumption per person is 5 mega watts greater than in the US, i.e. is about $17.7 \div 12.7 \approx 1.4$ times that of the US. This is likely due to the much greater need for heat during the fall/winter/spring months, being that Canada's population lives much farther north than most of the US population.