

# Energy and Power Practice

## Physics and Mathematics of Sustainable Energy

College of the Atlantic. January 13, 2021

Some facts:

- Average Maine house uses 520 kWh of electricity every month
- Average Texas house uses 1130 kWh of electricity every month
- On average, generating a kWh of electricity in the US leads to 0.45 kg of CO<sub>2</sub> being emitted.
- The per capita greenhouse gas emissions of the US is around 18 tons of CO<sub>2</sub>e very year.
- Electricity in our part of Maine costs roughly 0.16 per kWh.

1. Some warm-up problems

- (a) An electric toaster draws 1200 W. If I make toast for half an hour, how much energy has the toaster used? How much would this cost in Maine
- (b) An electric dryer uses 20 kWh in 3 hours. What average power does the dryer draw during this time?

2. Suppose you leave a 1500 W electric heater is on for 8 hours in a day.

- (a) How much energy does this use?
- (b) How much would this cost in Maine?
- (c) Now suppose that you left this heater on for 8 hours every day during Maine's six-month-long winter season. How much energy is this?
- (d) How much would this cost?
- (e) How much CO<sub>2</sub> would be emitted as a result of this electrical energy use? Is this a lot or a little?

3. Which of the following are units of energy? Which are units of power? Which units don't make sense?

- (a) kW
- (b) kWh
- (c) Joules
- (d) kW/h
- (e) MW
- (f) kWh/day

4. The average home in Texas uses 1130 kWh of electricity in a month. Very roughly, what size power plant would be needed to power a town of 50,000 in Texas?