# Solar PV

Physics and Mathematics of Sustainable Energy

College of the Atlantic. October 24, 2025

1. The average insolation in Bar Harbor, ME, is 4.29 kWh/day/m$^2$. Convert this to W/m$^2$.

2. Let's look at one of COA's solar installations and calculate its

   (a) Capacity Factor

   (b) Power density (W/m$^2$)

3. We have 18 PV panels on our barn. The total capacity is 7.6 kW.

   (a) How much electrical energy would be generated by these solar panels in a year? (Assume a capacity factor of 13%.)

   (b) What is the average energy generated per month? Put this number in perspective.

   (c) How much would a year's worth of this electricity be worth in Maine?

   (d) If this electricity displaced electricity that was generated with a carbon intensity of 300 g of $CO_2$, how much less $CO_2$ would be emitted over one year as a result? Is this a little or a lot? (Assume a carbon intensity of 300 g $CO_2$e per kWh for the Maine electricity that your solar would displace, and a carbon intensity of 46 g/kWh for the solar panels.)

4. A typical new house in the US might have around 50 m$^2$ of rooftop on which solar panels can be installed. The average monthly electricity consumption for a US home is around 900 kWh/month.

   (a) How much electrical energy would be generated by these solar panels in a month? In a year?

   (b) How much would a year's worth of this electricity be worth in Maine?

   (c) How does this amount of electricity compare to the electricity used in the home?

   (d) How does this compare to the total amount energy used in the US per person per year?

   (e) If this electricity displaced electricity that was generated with a carbon intensity of 450 g of $CO_2$, how much less $CO_2$ would be emitted as a result? Is this a little or a lot?