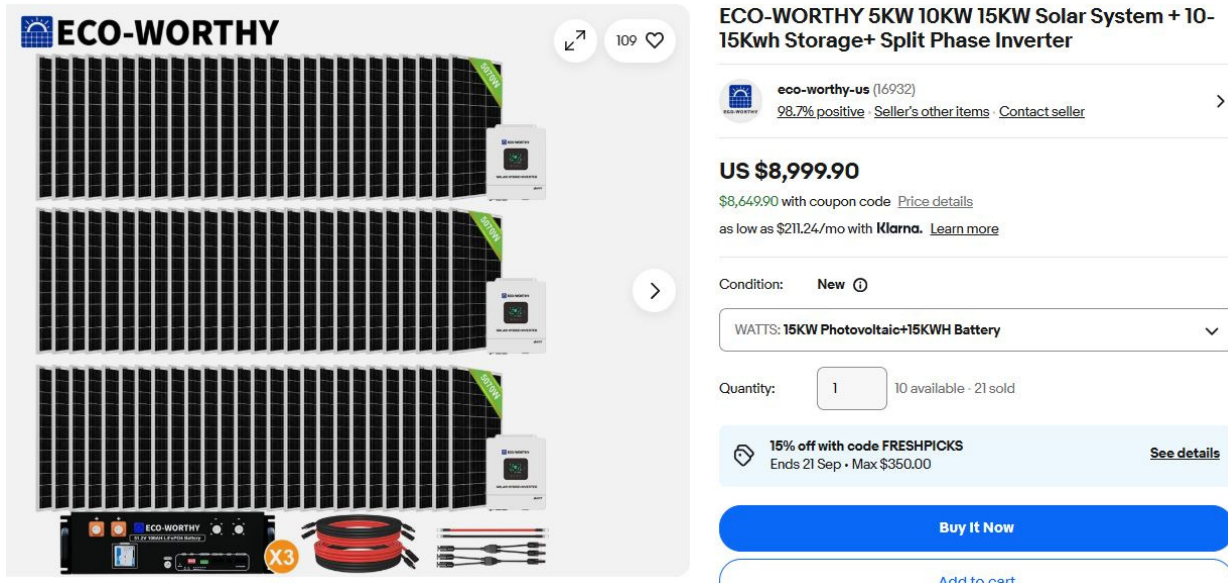


ECE 111 - Homework #5:

Renewable Energy

Solar Energy

A 15kW split phase solar power system with a 15kWh battery sells on ebay for \$8,649 (September 19, 2025). Is this a good buy?



ECO-WORTHY

ECO-WORTHY 5KW 10KW 15KW Solar System + 10-15Kwh Storage+ Split Phase Inverter

eco-worthy-us (16932)
98.7% positive · Seller's other items · Contact seller

US \$8,999.90
\$8,649.90 with coupon code [Price details](#)
as low as \$211.24/mo with [Klarna](#). [Learn more](#)

Condition: **New**

WATTS: 15KW Photovoltaic+15KWH Battery

Quantity: 10 available - 21 sold

15% off with code FRESHPICKS
Ends 21 Sep • Max \$350.00 [See details](#)

Buy it Now

[Add to cart](#)

1) Load 4-weeks worth of solar energy data from NDAWN. (any town in North Dakota or Minnesota). Plot this in MATLAB as wind speed vs hour.

- Month = September or March (around the equinox - kind of a fair date)
- <https://ndawn.ndsu.nodak.edu/>
- Hourly Data
- Solar Radiation - Total (MJ/m^2)

Plot the solar radiation vs. hour in Matlab

2) Calculate the energy generated in kWh over these 28 days for the array

- 78 panels
- Each panel has an area of 0.89 square meters
- Panel efficiency = 21.5%

3) Calculate

- The total energy produced over the month in kWh,
- The value of this energy, assuming 11 cents per kWh, and
- The number of pounds of coal this array offsets over this month (assuming 1.78 lb of coal = 1kWh)

4) How many years will it take for this solar panel array to pay for itself?

- Assume each month is the same (kind of iffy)
- How many months (or years) will it take to generate \$8,649?

Wind Energy

5) Load the 4-weeks worth of average wind-speed data from NDAWN. (any town in North Dakota or Minnesota). Plot this in MATLAB as wind speed vs hour.

<https://ndawn.ndsu.nodak.edu/>

6) Write a function in Matlab where you pass the wind speed at 120m (about 1.8x the wind speed at the ground) and it returns the power generated by a Vestas V120-2.2 MW

Wind Speed (m/s)	0..3	4	5	6	7	8	9	10	11	12	13+
kW	0	16	152	335	604	873	1,212	1,559	1,864	2,079	2,200

https://www.vestas.com/content/dam/vestas-com/global/en/brochures/onshore/2MW_Platform_Brochure_.pdf.coredownload.inline.pdf

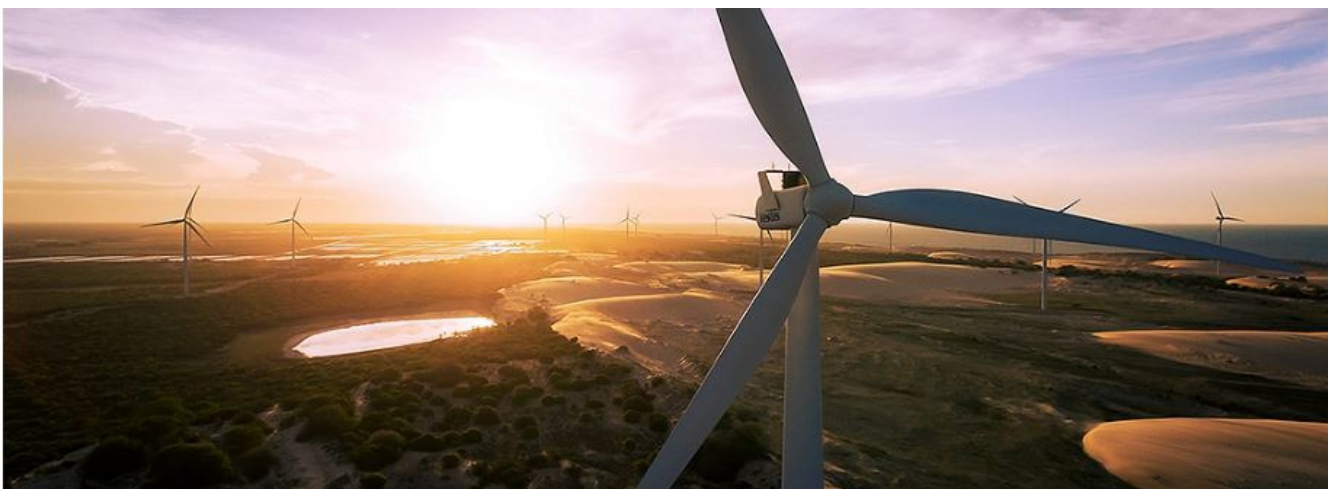
6a) Determine a function in Matlab to approximate this curve.

6b) Use this function to compute how much power a Vestas V136-3.45MW wind turbine would produce from the wind data your found in problem 5.

7) Calculate

- The total energy produced over the month in kWh,
- The value of this energy, assuming 11 cents per kWh, and
- The number of pounds of coal this array offsets over this month (assuming 1.78 lb of coal = 1kWh)

8) Assume this wind turbine costs \$2.86 million to build (\$1300 / kW). How long will it take for this wind turbine to pay for itself?



https://www.vestas.com/content/dam/vestas-com/global/en/brochures/onshore/2MW_Platform_Brochure_.pdf.coredownload.inline.pdf