EE 446/646 – Assignment # 5 (Final)

Continuing with the previous assignment # 4, suppose that the $3.96 kW system costs $7,800 after the local utility rebate and federal tax credit.

1) Determine the NPV of the PV system for a 20-year life. Assume a discount rate of 5%. After how many years the NPV switches from negative to positive value?
2) After hearing about the energy storage rebate and associated federal investment tax credit (FITC), the customer is seeking assistance in evaluating the installation of a Tesla Powerwall battery storage system. These incentives require that the customer enroll in the ToU rate schedule. In addition, the battery can charge ONLY from the PV system, i.e., it can only perform PV energy shifting. Estimate how much cost savings/year the storage system can provide, then calculate the NPV of 10-year life and same discount rate above. Assume the following:
   a) The battery initial cost is $7,000. The rebate is $3,000, the FITC is 30%, then the final cost is $2,800.
   b) The battery can draw up to 15 kWh (full charge), but delivers 13.5 kWh (i.e., its round-trip efficiency = 90%). Ignore all other battery constraints.
3) **For graduate students only**. Instead of installing the above battery, an alternative option to reduce the energy bill is to upgrade the PV system. Suppose the $2,800 above will allow the customer to add 3 more PV panels and exchange the inverter to handle such extra power. Calculate the resulting additional savings/year and make a comparison to the above option.

Table 1: Local Electric Utility Electricity ToU and Net-Metering Rates for Single-Family Homes.

Rate Type	**Month**	**Time of Day**	**Cost ($/kWh)**
Net-Metering rate	January-December	1:00-24:00	-$0.09
ToU Summer-on-peak	June - September	13:00-19:00 (weekdays only)	$0.44
ToU Summer-off-peak	June - September	19:00-13:00 weekdays 1:00-24:00 weekends	$0.06

ToU Rest-of-the-Year	October - May	1:00-24:00 (all day)	$0.05

Show all your work clearly please.