# EE 446/646 – Fall 2015 – Final test (take-home-portion – worth 25% of final grade)

Name:…………………………………….

You are asked to design an off-grid PV system with battery storage to provide electric power to an oil pump jack outside San Antonio, TX (refer to the solar insulation table on page 680 of you book). The power demand of the pump is shown below. Note the regenerative breaking power that can be harnessed, and the average power draw is equal to 10 kW
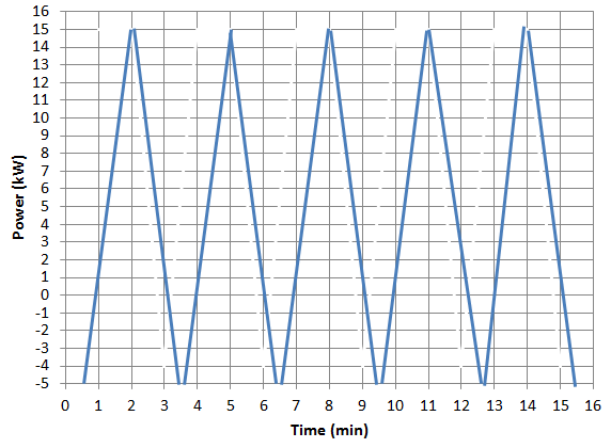
1) Size a battery bank to serve the load for 3 days without any charging from the PV array. Ignore all losses (i.e. the battery and inverter are 100% efficient). However the battery DOD should not exceed 80%.

2) Use PVWatts to size a PV system to meet the 75% of the load demand during the worst winter month (January). Assume zero system losses, and a tilt angle of 45 degrees.

3) Now combine the above battery back, PV system and load. Suppose that you start with a fully charged battery on the first day of January. Use the hourly data of PVWatts and determine the hourly battery DOD. Then determine the % availability (i.e., % of the 8,760 hours where there is insufficient power) Keep in mind that the system cannot serve the load if the DOD is below 80%, and some power has to be "dumped" when the PV system is generating more power that the load demand while the battery if fully charged. Determine the % of the total PV annual energy that had to be "dumped".

- Print the hourly battery DoD, and the hourly extra PV power that was dumped.