APES Energy lab: ROI/TCO

1. The PV panels as part of the PPA array produce 250 Watts in ideal sunlight. The cost for this panel today is about $0.50 per Watt (was $14.00 per Watt 10 years ago)
2. Calculate the price for each panel
3. If this panel collects 5.5 hours of sunlight per day, how many kWh does it produce each day?
4. At $0.40 per kWh, how much money does this panel harvest each day?
5. Divide the price by the amount collected per day, this should give you the number of days needed to pay off the panel.
6. How many days or years is this? This is called ROI or return on investment.
7. Total cost of ownership (TCO) is the total cost of operating the system. If the system lasts 25 years, how much money would it produce?
8. Subtract the cost of the unit from the money the unit produced, the result is the TCO, or total cost of ownership. If this is negative, you made money on the system.
9. Repeat these steps using $14.00 per Watt:

Solar PV panel:
- $14.00 per Watt
- 250 Watts
- 5.5 hours per day production
- lifespan 15 years (panel warranty)
- ROI:
- TCO:

Solar thermal panel:
- 2.5 m2 area
- 1500 W/m2 solar insolation
- 5.5 hours per day
- cost: $900
- lifespan: 30 years
- ROI:
- TCO:

Wind turbine:
- 2 kW output
- 8 hours per day (night time too)
- cost: $10,000
- lifespan: 5 years
- ROI:
- TCO:

check your answers:

PV (present day)
- $0.36 per day
- 230 days or .63 years or 7.6 months
- $-3202

solar thermal
- $20.62 per day
- 43 days or 0.11 years, or 1.5 months
- $-224889

wind
- $6.40 per day
- 1562 days or 4.3 years, or 4 years 4 months
- $+656 (note cost of device)

Lab questions:
1. A solar panel is 2m x 1.5 m and collects 120 Watts in solar radiation of 1000 W/m2. What is the efficiency?
2. How much heat energy could we collect from a solar thermal panel 3m x 2m in 1500 W/m2 solar insolation?
3. What are the three clues we can use to detect energy use on a telemetry system like eGauge?
4. Energy storage and efficiency are keys to the ROI and TCO of the devices above. Explain.
5. Why would the nasty numbers for the wind turbine be offset by the high price of electrical energy storage? (hint: think of the garden)
6. Storing 15 kWh of energy as hot water using a well insulated hot water tank costs $1000. How much is this per kWh?
7. About how many hours can this store the energy (stay hot)?

8. Lithium storage batteries like those in the student union now cost $500/kWh for a 10 kWh system. How much did this cost?
9. How long can this store the energy?
10. Why is insulating a hot water heater so important?