

ECE 333 Green Electric Energy

Homework 4

Date set: 10/05/2021

Solution to be uploaded on course website: Tuesday, 10/12/2021

Quiz Date: Thursday, 10/14/2021 (during class)

The quiz has one or more problems based on the assigned problems below

Reading:

Text: From Masters' 2nd edition

- appendix A

Solve the following problems:

Problem 1. Better windows for a building adds $\$3/\text{ft}^2$ of window but saves $\$0.55/\text{ft}^2$ in the reduced heating, cooling and lighting costs. With a discount rate of 12%

- What is the NPV of the better windows over a 30-year period with no escalation in the value of the annual savings?
- What is the IRR with no escalation rate?
- What is the NPV if the savings escalate at 7% per year due to fueling savings?
- What is the IRR with the escalation rate?

Problem 2. A 30 kW PV system on a building reduces the peak demand by 25 kW and reduces the annual electricity demand by 60,000 kWh/yr. The PV systems cost \$135,000 to install, has no annual maintenance costs, and have an expected lifetime of 30 years. The utility rate structure charges \$0.07/kWh and \$9/kW per month on demand

- What annual savings in utility bills will the PVs deliver?
- What is the IRR on the investment with no escalation in utility rate?
- What is the IRR on the investment if the annual savings on utility bills increases 6% per year?

Problem 3. A small, 10-*kW* wind turbine that costs \$15,000 has a capacity factor of 0.25. If it is paid for with a 6-%, 20-*year* loan and it is an equal payment cash flow set, what is the cost of the electricity generated if the wind turbine always works at 10-*kW*?

Problem 4. A *PV* system that generates 8,000 *kWh/yr* cost \$15,000. It is paid for with a 6%, 20-*year* loan. Ignoring any tax implications, what is the electricity cost from the *PV* system