Quiz 8

1. (2 pts) Define levelized cost of energy (LCOE) using a mathematical expression.

\[
\text{LCOE (\$/kWh)} = \frac{\text{Annual Fixed Cost} + \text{Annual Var Cost (\$/yr)}}{\text{Annual Output (kWh/yr)}}
\]

b. (2 pts) What is LCOE used for in power system planning?

LCOE enables system planners to have a single cost per kWh capturing fixed (infrastructure) and variable costs (fuel, O&M) to compare different energy supply systems.

c. (2 pts) Describe demand side management.

Utilities use demand side management to encourage users to control their energy consumption → i.e. encourage energy conservation.

d. (2 pts) Why is demand side management important in integrated power resource planning?

DSM encourages reduced energy consumption → (or reshaped demand curves) to reduce the need for building new infrastructure to meet energy/power demand – esp. a peak periods and promote conservation.

e. (2 pts) Define simple payback (yr).

\[
\text{Simple Payback} = \frac{\text{Extra 1st Cost} \Delta P (\$)}{\text{Annual Savings (\$/yr)}} \text{ (yr)}
\]
2. You have a project that returns $1000 and $2000 at the end of years 1 and 2 respectively. Your initial investment is $2400 at the outset.  

\[ d = 10\% \] \( \text{given in class} \)

a. (2.5 pts) Draw the cash flow diagram

\[
\text{\$2400} \quad \downarrow \\
0 \quad 1 \quad 2 \quad \text{YEARS} \\
\uparrow \quad \uparrow \\
\text{\$1000} \quad \text{\$2000} \\
\downarrow \\
\text{\$2400} \\
\downarrow
\]

b. (2.5 pts) What is the net present value?

\[
NPV = -2400 + (1 + 0.10)^0 \times 1000 + (1 + 0.10)^1 \times 2000 \\
\]

\[
= \frac{1}{6} \text{ANS.}
\]

3. You want to borrow $2000 at 6% rate to be repaid back in equal payments over 5 years.

a. (2.5 pts) Compute the annual payment.

\[
A = P_0 \cdot CRF = P_0 \left[ \frac{i \cdot (1+i)^n}{(1+i)^n-1} \right] = 2000 \left[ \frac{0.06 \cdot (1+0.06)^5}{(1+0.06)^5-1} \right] \\
= 474.97 \text{ANS.}
\]

b. (2.5 pts) Draw the cash flow diagram.

\[
\text{\$2000} \\
1 \quad 2 \quad 3 \quad 4 \quad 5 \\
\text{\$474.97}
\]