

# Lesson 8-3 – Multiple Alternatives

# Multiple Alternatives

- Two or more alternatives can be handled by present worth analysis.
- The NPV can be evaluated for each project.
  - **\*\*\*Must evaluate to a common lifetime or analysis period\*\*\***
- Economic evaluation is based on the highest (most positive or least negative) NPV.

# Multiple Alternative Example

- Winter is here. Your furnace just bit the dust. You have three options to replace it. All have expected lifetimes of 20 years
- Gas fired furnace
  - Installation cost: \$8,000
  - Annual fuel costs: \$1200 per year, rising 5% per year
- Geothermal heat pump
  - Installation cost: \$23,000
  - Annual electricity costs: \$400 per year, rising 4% per year
- Electric baseboard heaters
  - Installation costs: \$2,200
  - Annual electricity costs: \$1900 per year, rising 4% per year
- Installer will finance at 7%



# Multiple Alternative Example

- Gas furnace:  $P = \$8,000 + \$1200 (P/g, 7\%, 5\%, 20) = \$26,860$
- Heat Pump:  $P = \$23,000 + \$400(P/g, 7\%, 4\%, 20) = \$28,784$
- Baseboards:  $P = \$2,200 + \$1,900(P/g, 7\%, 4\%, 20) = \$29,672$
- Most economical alternative?

$$P_g = A_1 \left[ \frac{1 - \left( \frac{1+g}{1+i} \right)^n}{1 - g} \right] \quad g \neq 1$$

# Present Worth Analysis: Multiple Alternatives

BC Hydro is looking at adding two backup power supplies at one of its dams. All the systems are designed to last 20 years. BC Hydro's interest rate is 15%.

Option 1: Diesel generator, \$20,000 plus \$2000 per year

Option 2: Battery System: \$30,000 , plus \$10,000 in year 10

Option 3: HV Transmission line: \$50,000, no operating costs



# Present Worth Analysis: Multiple Alternatives

Multiple alternatives. Fixed output, so minimize costs.

$$P1 = \$20000 + \$2000(P/A, 15\%, 20) = \$20000 + \$2000(6.259) = \$32518$$

$$P2 = \$30000 + \$10000(P/F, 15\%, 10) = \$30000 + \$2472 = \$32472$$

$$P3 = \$50000$$

Fixed output – two backup power systems. Minimize costs.

Minimum = P1 + P2. Hydro should use the Diesel Generator and the Battery System.

<i>n</i>	Present Worth Factor Find <i>P</i> Given <i>A</i> <i>P/A</i>
1	0.870
2	1.626
3	2.283
4	2.855
5	3.352
6	3.784
7	4.160
8	4.487
9	4.772
10	5.019
11	5.234
12	5.421
13	5.583
14	5.724
15	5.847
16	5.954
17	6.047
18	6.128
19	6.198
20	6.259
---	---