WATER RESOURCES MANAGEMENT

LECTURE 3 – DECISION MAKING AND ENGINEERING ECONOMY

ENGINEERING ECONOMY

- Application of economics principles to assign value to an alternative
- Decision principles used to select the best alternative based on value

DETERMINING ECONOMIC VALUES

- Economic value – a basis for comparisons
- Definitions/Concepts
- Economic Analysis
  - Principles of engineering economics
  - Cash flows
  - Discounting methods

DETERMINING ECONOMIC VALUES

- Economic value – a basis for comparisons
- Values appear at different times in an alternative
- Values appear as different kinds in an alternative

EQUIVALENCE OF KIND

- Consider two designs; same cost to build (in monetary terms)
  - Project 1 produces x tons of peaches
  - Project 2 produces y bales of cotton
- Tons of peaches and bales of cotton are not directly comparable – they are different "kinds" of outputs.
  - Could use some kind of conversion rate: y' tons peaches = y bales of cotton
  - Kind of a nuisance, usually use monetary units;
    1 ton peaches = X dollars
    1 bale cotton = Y dollars

EQUIVALENCE OF TIME

- Consider two designs; same cost to build (in monetary terms)
  - Project 1 produces x tons of peaches
  - Project 2 produces y bales of cotton
- When are the peaches available? How about the cotton?
  - X dollars today, or X dollars in 5 years? Which is more valuable today?
- Comparisons need to account for arrival times of the benefits (and costs)
- Usually use cash-flow concepts and monetary discounting

WHO BENEFITS

- Viewpoints (for decision making)
  - The project sponsor
  - The project community (who uses the outputs and derive indirect benefit)
  - The entire “nation”

SUNK COSTS

- Should compare alternatives on their value only – disregard history unless affect future cash flow.
- Sunk costs are expenses already used; are not recoverable.
  - ”Don’t throw good money after bad …”

INCREMENTAL COSTS

- Decision to add cost to a project is defendable if the incremental benefit increase exceeds the incremental cost

INTANGIBLE

- Some things are really hard to assign a monetary value
- These are called intangible or irreducible
- Surrogate values can be assigned by policy
  - Human lives have a policy assigned monetary value:
    - The New York Times reports that the Environmental Protection Agency values human life at $9.1 million.
    - In 2008, the FDA valued human life at $5 million, today their figure sits at $7.9 million.
    - State of Texas valued human life at $250,000 (Tort value cap)

UNCERTAINTY

- Comparing alternatives usually has to look into the future – inherent uncertainty
  - Uncertain objectives
  - Uncertain constraints
  - Uncertain public response
  - Uncertain technological change
  - Uncertainty in recurring events (e.g. flooding magnitude and times)

PLANNING HORIZON

- Design life (economic)
  - Typically 50 to 100 years
- Service life (physical life)
  - Variable – technology can change, need can change, the thing can break
- Compare things over the same period of analysis – using negative (salvage) cash flow if necessary to use comparable planning horizons

ALTERNATIVE STRUCTURE (FOR COMPARISONS)

- Alternatives capable of achieving the design objective should be defined
- Identify consequences of each alternative and express in monetary units
- Comparisons should be on cost-to-go (to eliminate consideration of sunk costs)
- Intangibles should be identified – search policy to see if economic values are already assigned (or surrogates are available)
- Compare on uniform basis over common analysis periods