L11 APSC221 - Replacement Decisions

When Do We Replace an Asset?

Options

Physical assets should be periodically evaluated as they age. The main options are:

1. **Keep** the asset (do nothing)
2. **Overhaul** the asset to improve efficiency
3. **Dispose** of the asset without replacement
4. **Replace** the asset with a new one

Reasons for Replacement or Retirement

- **Replacement**: Due to declining efficiency or loss of market competitiveness
- **Retirement**: When the asset's service is no longer needed

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How Long Should We Keep an Asset?

- Relevant costs are not always obvious
- Understanding the asset's **economic life** is critical—distinct from its physical or service life
- **Economic life**: The point at which the cost of keeping the asset outweighs the economic benefit it provides

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Asset Costs

Capital Costs

- Purchase cost – Salvage value (adjusted for time value of money)

Installation Costs

- One-time, non-recoverable, sunk costs

Operating & Maintenance (O&M) Costs

- Ongoing costs of using the asset
- Typically increase over time

Equivalent Annual Cost (EAC)

EAC provides a way to compare costs that vary over time.
Unlike regular annual cost, EAC changes each year based on time and cost structure.

Formulas:

- **Capital Cost EAC**

$$EAC_{capital} = (P - S)(A/P, i, N) - S * i$$

- **Operating & Maintenance EAC**

$$EAC_{O\&M} = \sum \text{Annualized cash flows}$$

- **Total EAC**

$$EAC_{total} = EAC_{capital} + EAC_{O\&M}$$

Replacement Scenarios

- **Defender**: The current asset
- **Challenger**: The potential replacement asset

Scenario 1: *Identical Defender and Challenger*

- Asset need is indefinite
- Life cycle repeats (e.g., software, electronics)
- Assumes stable tech, prices, and interest rates

Decision Rule:

- Replace when **EAC_capital is minimized** (i.e., at economic life)

Scenario 2: *Different Defender and Challenger (same challenger continues indefinitely)*

- Example: Flip phone vs. smartphone
- Assumes stable external conditions

Decision Process:

1. Determine economic life and **EAC_c** of challenger
2. Determine remaining life and **EAC_d** of defender
   - If **EAC_d > EAC_c**, replace now
   - Else, monitor until EAC*d > EAC_c at year _n*, and replace at year **n - 1**

Notes:

- **Sunk costs are excluded**
- **Defender's initial cost (P)** = present opportunity cost
- **One-Year Principle**:

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- If capital costs are small and O&M costs increase steadily, economic
life of the defender = 1 year
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$$EAC_{total} = EAC_{O\&M}(n = 1)$$

Scenario 3: *Different Defender, Different Future Challengers*

- **Not covered in this course**