

## Engineering Economy Edition William Sullivan

Engineering Economy Edition William Sullivan Engineering Economy William Sullivan Edition A Comprehensive Guide Engineering Economy authored by William G Sullivan and his coauthors often including Elin M Wicks and James E Luxhoj in later editions is a cornerstone text for students and professionals alike This guide explores the core concepts methodologies and practical applications presented in the book providing a stepbystep approach to mastering engineering economic analysis

**I Understanding the Fundamentals**

**Time Value of Money TVM** The bedrock of engineering economy lies in the time value of money TVM Money available today is worth more than the same amount in the future due to its potential earning capacity Sullivans text thoroughly covers various TVM techniques including Simple Interest Interest calculated only on the principal amount Formula  $I = P \cdot i \cdot n$  where  $I$  interest  $P$  principal  $i$  interest rate  $n$  number of periods Example A 1000 investment at 5 simple interest for 2 years earns 100 annually totaling 200 in interest

**Compound Interest** Interest earned on both the principal and accumulated interest This is the foundation of most engineering economic analyses Future value  $F$  and present value  $P$  calculations are crucial

**Future Value  $F$**   $F = P(1 + i)^n$  This formula calculates the future worth of a present sum Example 1000 invested at 5 compounded annually for 2 years becomes  $F = 1000(1.05)^2 = 1102.50$

**Present Value  $P$**   $P = \frac{F}{(1 + i)^n}$  This determines the present worth of a future sum Example 1102.50 received in two years discounted at 5 has a present value of  $P = \frac{1102.50}{(1.05)^2} = 1000$

**II Key Methods for Economic Analysis**

Sullivans book details several methods for comparing different engineering projects and investment options These include

**Present Worth Analysis PW** All cash flows are discounted to their present value The project with the highest PW is preferred Example Comparing two projects A with PW 5000 and B 2 with PW 3000 project A is selected

**Annual Worth Analysis AW** Converts all cash flows into equivalent annual amounts Useful for comparing projects with different lifespans This involves calculating the equivalent uniform annual cost EUAC or equivalent uniform annual benefit EUAB

**Future Worth Analysis FW** Similar to PW but all cash flows are compounded to their future value The project with the highest FW is selected

**Rate of Return ROR Analysis** Determines the interest rate at which the net present worth NPW of a project equals zero Projects with ROR exceeding the minimum attractive rate of return MARR are acceptable This often requires iterative calculations or financial calculator/software

**BenefitCost Ratio BC Analysis** Compares the total benefits to the total costs of a project A BC ratio greater than 1 indicates a favorable project

**III StepbyStep Guide to Economic Analysis**

- 1 Define the Problem Clearly state the projects objectives and scope
- 2 Gather Data Collect all relevant cost and revenue information including initial investment operating costs salvage value and expected lifespan Accurate data is crucial for reliable results
- 3 Select an Analysis Method Choose the appropriate method PW AW FW ROR BC based on the projects characteristics and the decision criteria
- 4 Perform the Calculations Use appropriate formulas or software to calculate the economic measures
- 5 Compare Alternatives

Compare the results for different projects and select the most economically viable option

**6 Consider NonEconomic Factors** While economic analysis is critical remember to consider qualitative factors like environmental impact social responsibility and safety

**IV Best Practices and Common Pitfalls** Use Consistent Units Ensure all cash flows are expressed in the same currency and time units Account for Inflation Adjust cash flows for inflation using appropriate inflation rates to ensure accurate comparisons

**3 Consider Depreciation** Properly account for depreciation of assets over their lifespan

**Sensitivity Analysis** Conduct sensitivity analysis to assess the impact of uncertainties in input parameters on the final results Beware of Sunk Costs Avoid including sunk costs past expenditures in the analysis as these are irrelevant to future decisions

**Properly Handle Salvage Value** Accurately estimate the salvage value of assets at the end of their useful life

**Dont Overlook Taxes** Include taxes in your cash flow projections especially for large projects

**V Software and Tools** Several software packages simplify engineering economic analysis including specialized financial calculators spreadsheet software like Excel with its financial functions and dedicated engineering economy software Mastering these tools significantly enhances efficiency and accuracy

**VI Summary** Sullivans Engineering Economy provides a robust framework for evaluating engineering projects Understanding the time value of money and mastering the various analysis methods PW AW FW ROR BC are essential skills Accurate data collection careful consideration of noneconomic factors and the use of appropriate software are crucial for effective and reliable engineering economic analysis

**VII FAQs**

**1 What is the Minimum Attractive Rate of Return MARR** The MARR is the minimum acceptable rate of return an organization requires for an investment It reflects the opportunity cost of capital and the risk associated with the project Its used as a benchmark to evaluate the profitability of projects

**2 How do I account for inflation in my analysis** You can use either the thencurrent dollar approach nominal analysis or the constantdollar approach real analysis The thencurrent approach uses actual inflated dollars while the constantdollar approach converts all cash flows to a base year using an inflation adjustment factor

**3 What is the difference between PW and AW analysis** Present Worth PW analysis finds the equivalent present value of all cash flows while Annual Worth AW converts all cash flows 4 into equivalent annual values AW is particularly useful when comparing projects with unequal lifespans

**4 How do I handle uncertain cash flows** Employ probabilistic methods like Monte Carlo simulation to model uncertainty and generate probability distributions of project outcomes Sensitivity analysis can also help identify the most critical input parameters

**5 What are some examples of noneconomic factors to consider** These include environmental impact pollution greenhouse gas emissions social impacts job creation community disruption safety considerations risk assessment accident prevention and ethical considerations fair labor practices sustainability A thorough analysis must consider these qualitative factors in addition to financial data

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