



Essentials of Economic Decision Analysis for Chemical Engineering

Ralph W Pike

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There are things that chemical engineers need to know and things that they need to know about. They need to know the time value of money, and they need to know about using Solver in Excel for process optimization problems. They need to know how to describe a process or plant in a flowsheeting program, and they need to know about the options for the thermodynamic packages in the flowsheeting program. They need to know how to do material and energy balances on chemical processes, and they need to know about how to incorporate rate equations and equilibrium relations in the material and energy balance equations. The topics in economic decision analysis given here have details to ensure the depth for need to know and the breadth for the topics that are in the need to know about category. The topics follow in order of developing the information needed for economic decision analysis. Beginning with market analysis, this leads to the decision to evaluate a new process or plant. Then several levels of analysis are used to determine cost of manufacturing a new product to compare with the sales estimated from the market analysis. Profitability analysis uses the net present value, rate of return and the economic price for decisions. Total cost assessment used the triple bottom line to incorporate economic, environmental and sustainability costs and sustainability credits in the decision analysis. The optimal configuration of plants in a chemical production complex was evaluated using global optimization to the determination the best value of triple bottom line. Results included using multiobjective optimization to determine Pareto optimal solutions. Monte Carlo simulation was used to determine the sensitive of the optimal solution to the parameters in the constraint equations. Three appendices are included. In Appendix A, typical estimating charts are given for individual equipment cost and plant cost for use with quick estimation of total plant costs to be used with total product costs for preliminary estimates of profitability. In Appendix B supply and demand elasticity are described with evaluations for corn as a feed and a fuel, illustrating the difficulty in finding data to do the evaluation of these frequently used concepts. In Appendix C the latest status on global optimization is summarized with the currently more successful algorithms available in GAMS.

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