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SLAM APPLICATIONS IN ECONOMIC MODELING OF LARGE INVESTMENT PROJECTS

Mehdi Manesh
ATAC
Mountain Bay Plaza
P.O. Box 370
Mountain View, CA 94042

SLAM (Simulation Language for Alternative Modeling) is a Fortran-based language with network, discrete event, and continuous modeling capabilities. This simulation language has been widely used in industrial engineering and operations research. Applications of SLAM are also of great value in the economic modeling of large investment projects.

The use of SLAM for simulating cash flows facilitates the development of the necessary computer code to test and validate economic risk analysis. The unique process orientation of SLAM employs a network structure comprised of special symbols called nodes and branches in a manner similar to Q-GERT. The modeling task consists of combining these symbols into a network model which pictorially represents the system of interest. Due to the flexibility inherent in SLAM the complexities involved with programming nondeterministic economic models are substantially reduced. As a Fortran-based simulation language SLAM provides the option of processing and analyzing the input data through Fortran subroutines within the program.

This paper reviews Monte Carlo simulation models developed for: (a) the economic comparison of oil and coal power plants with emphasis on examining the cost of pollution control; (b) studying the economic feasibility of using coal to produce synthetic natural gas; and (c) an economic evaluation of using synthetic natural gas to produce electricity.

An extensive analytical model was developed as a basis for each of these simulation models in which the inflated capital, fuel, and operating and maintenance costs were accounted for to calculate the equivalent annual cost of cash flows over the project life. Major elements of uncertainty were identified and the associated probability distributions were estimated in terms of "optimistic", "pessimistic", and "most likely" values. It was assumed that these three estimates correspond to the "upper bound", "lower bound", and "mode", respectively, of a Beta distribution with a standard deviation equal to one-sixth (1/6) of the spread between the lower and the upper bounds.

A sufficiently large number of Monte Carlo simulation trials was selected to reduce sampling variation to an acceptable level in view of the accuracy needed and resource availability. The distributions resulting from the Monte Carlo analysis were compared for all alternatives. Then the interrelationship and sensitivity of these alternatives to changes in the input parameters were analyzed.

According to the results achieved with 300 observations in a simulation run, the expected equivalent annual cost of the oil power plant was higher than that of the coal power plant. The same conclusion was reached with the standard deviations of costs of the two alternatives, indicating that the risk involved with the oil power plant is higher than the associated risk with the coal power plant. The construction costs, expected escalation rates for fuel, operating and maintenance costs, load factors, and discount rates were identified as the parameters significantly influencing the final results.

In the second application, synthetic fuel production was subject to many technological uncertainties, and was found to be economically unattractive. The costs associated with generating electricity by using synthetic natural gas were found to be substantially higher than the respective costs related to oil burning power plants. However, assuming higher oil prices, the economic feasibility of producing synthetic natural gas from coal increases substantially.

The selection of SLAM as the simulation language simplified the programming effort. A significant advantage of the program developed for this study is its flexibility and capability of handling various conditions when evaluating the economics of large investment projects. Development of an interactive version of SLAM could put the package at the reach of a wider range of users. The role of the user would be reduced to selecting options offered by the program and to entering the data pertaining to his specfic case, without having to master the SLAM simulation language.

TESS (The Extended Simulation System) has been developed to complement SLAM capabilities. TESS supports all aspects of SLAM simulation including model building, execution of simulation runs, and statistical output analyses. TESS also provides color graphics for the statistical output analyses.

BIOGRAPHY

Mehdi Manesh is an Operation Analyst at Analytical Technology Applications Corporation (ATAC) located in Mountain View, California. He received his M.A. Degree in Economics and his M.S. Degree in Industrial Engineering from the University of Central Florida. His interests include Simulation, Statistics, and use of computers in planning and decision making. In his current position with ATAC he is engaged in Simulation and Analysis of FAA project.