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## Book Review

Mohan Munasinghe, *The Economics of Power System Reliability and Planning: Theory and Case Study* (Baltimore: The Johns Hopkins University Press, 1979)

This state-of-the-art book on the economics of power system reliability is a timely contribution to the understanding of the tradeoff between the rising unit cost of supplying electricity and the cost imposed on consumers by reduced reliability and power shortages.

The simulation methodology used to elucidate the tradeoff starts from the premise that society benefits most from a power system supply that minimizes both the outage cost to consumers and the cost of the system itself. This novel approach goes well beyond the traditional engineering approach to power system planning, which has considered minimizing the cost of the system alone. The stimulating and controversial aspect of the approach for energy economists is the identification and measurement of consumer outage costs. The author discusses some relevant theory for residential, industrial, and other users in Part I, and in Part II presents a case study for Cascavel, Brazil, in which outage costs are estimated through survey methods.

As with the most empirical applications of any theory, there are a few shortfalls that should be noted. The case study is concerned with evaluating the distribution network only.

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A more global optimum of the whole system, including generation, transmission, and distribution subsystems, would result in a higher value of net social benefits than any one of these taken separately—as the author acknowledges on page 43.

Because of limited time and manpower resources, a sample of only 27 out of 9,000 electricity-using households was taken in Cascavel. In a study where the potential savings from the optimum over the least-cost plan turned out to be \$650,000, one would think that a sample larger than 0.3 percent of the population could have been funded. From this sample, direct estimates of outage costs were obtained by asking consumers how much extra they would be willing to pay to avoid outages of different durations at various times during the day. In addition, they were asked what additional amount they would be willing to pay the utility company if the current incidence of outages was halved or how much they would need to be compensated if the outage rate doubled. The analyst averaged these three figures to estimate outage costs that were then regressed against the net earnings rate. The averaging reduced the variability of outage costs, and hence distorted the statistical analysis given in Table 12.2.

Given the statistical analysis as presented, the author accepts the null hypothesis that the estimate of the  $\beta_2$  coefficient is not statistically different from 1.0, yet on page 168 he proceeds to discuss why it is in fact less than unity. Either that discussion is unnecessary, or else Munasinghe does not believe his statistical analysis.

In the cost-benefit analysis for the case study, certain assumptions had to be made about the economic development of the area for the period 1976–1996. But in developing countries the actualization of local government plans, and population and economic growth rates, are probably more uncertain than electricity outages. Casting the cost-benefit analysis in a framework of risk assessment or decisionmaking under uncertainty would help alert the reader concerning the unreliability of economic forecasts in developing countries.

In Part I, the theoretical approach to finding the optimum reliability level might also be broadened to include the possible variance of reliability. The approach of using the expected reliability (or certainty equivalent) level for a given price is likely to bias the estimates of outage costs downward. In other words, if consumers are risk averse to variance in reliability, then the outage costs should be higher than when risk neutrality is assumed, as in this case. This area, as well as those mentioned by the author on page 196, requires additional work. Future efforts might focus on short-run versus long-run effects, direct outage impact costs versus adaptation costs after the outage, and the effects of various pricing policies on optimum reliability levels.

Although there are some conceptual and empirical shortfalls in this work, the study is a step forward from previous attempts, which are reviewed in various sections of the book. The list of references should be helpful for researchers in the value-of-reliability area. The book is required reading for utility planners and regulators, who are likely to face off in the future concerning the tradeoff between the costs of supplying electricity and the costs of going in the dark more frequently.

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