Discussion

M. G. Lauby (MAPP CC, Minneapolis, MN): This paper is an important and interesting addition to the theory of collection and analysis of transmission outage data. The question pertaining to which technique gives better predictive results has been an area of discussion for some time now. This paper probes further into this area. I have a number of comments and questions.

The authors have discussed in detail the component and unit approaches and defined the predictive gains that can be encountered when addition detail is collected in the form of the "hybrid" approach. Indeed, if the appropriate amount of data is collected, the results are impressive. Have the authors performed work which would suggest the additional cost, in person-hours associated with each level of collection? This kind of cost/benefit analysis would help distinguish which method would be the most desirable for the use that will be employed. A better decision can be made pertaining to the desired results and the expected effort.

In addition, all collection schemes need to be assessed with their overall goal in mind. For a given effort, the "hybrid" approach may give the best predictive results, the "unit" approach the best historical performances for lines, and the "component" approach the best historical performance for equipment. The ultimate use of the data also is an important consideration.

Though the results obtained by this analysis are from 345 kV lines of the Commonwealth Edison Company, how site specific can the results be considered? Can utilities and pools expect to obtain the same predictive results as your organization realized? How much disaggregation would you expect for utilities and pools that cover large areas? What other parameters migh be important dummy variables?

However, the major contribution of this paper is that is explores how much predictive power can be acquired from the data collection techniques currently in use. The applications of this research are obvious, as regulations for nuclear off-site power are stiffened, and multiple outages become more crucial as the transmission network become more loaded. The procedures and definitions are also valuable considerations when analysis is being performed.

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G. L. Landgren, A. W. Schneider, Jr., M. P. Bhavaraju and N. J. Balu: The authors appreciate Mr. M. G. Lauby's discussion which raises some important questions such as cost/benefit analysis and the applicability of our conclusions to other systems.

Cost/benefit analysis was not performed in our work. The incremental effort to go from a "simple unit" approach to a "hybrid" approach could be considerable because of the required inventory data on circuit breakers and on common mode and dependent outage exposures. The additional person-hours required to collect such data and the associated cost can be estimated by a company but it is generally difficult to quantify in dollars the benefit of improved accuracy resulting from the additional data collection effort. The justification for improved accuracy is generally subjective depending upon the importance of the application. Estimation of probability of loss of a nuclear station's off-site power and planning of transmission reinforcements to improve network reliability under multiple contingencies are two examples of such applications.

As far as the applicability to other systems is concerned, we can only state that the methodology is applicable. The conclusions may not be applicable since the relative importance of common mode, dependent, and adverse weather outages could vary significantly in different parts of the country. For example, poor protective system practices may increase dependent outages in a system. Weather related outages and the accuracy of adverse weather modeling may not be important in areas with moderate weather conditions. Additional case studies are needed to learn more about these variations.

The discusser suggests that the hybrid approach would provide the best predictive results and the unit and component approaches provide the historical performance indices. It is important to note that historical performance indices have limited use in system planning and design applications. As shown in Reference 1, it is essential to use regression analysis and available outage and design data on all individual transmission units to predict outage performance as needed for planning the future transmission system.

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