

# Asset Management Support Tools for Electric Power Equipment



## Background

In recent difficult circumstances of the electric power industry, it is necessary to reduce maintenance costs of electric power equipment by rationalizing maintenance strategies of aged equipment. Therefore, in sections responsible for the maintenance, in addition to the improvement of diagnosis techniques, there is a great deal of interest in asset management techniques that incorporate economic indicators. The operating condition data, inspection data and diagnostic data are being gathered in utility companies, and attempts are being made to utilize them to support the maintenance strategy. CRIEPI is investigating techniques to support them. Effective programs for specific power equipment are being pursued.

## Principal results

(1) Support tool for dissolved gas analysis of oil-immersed power transformers

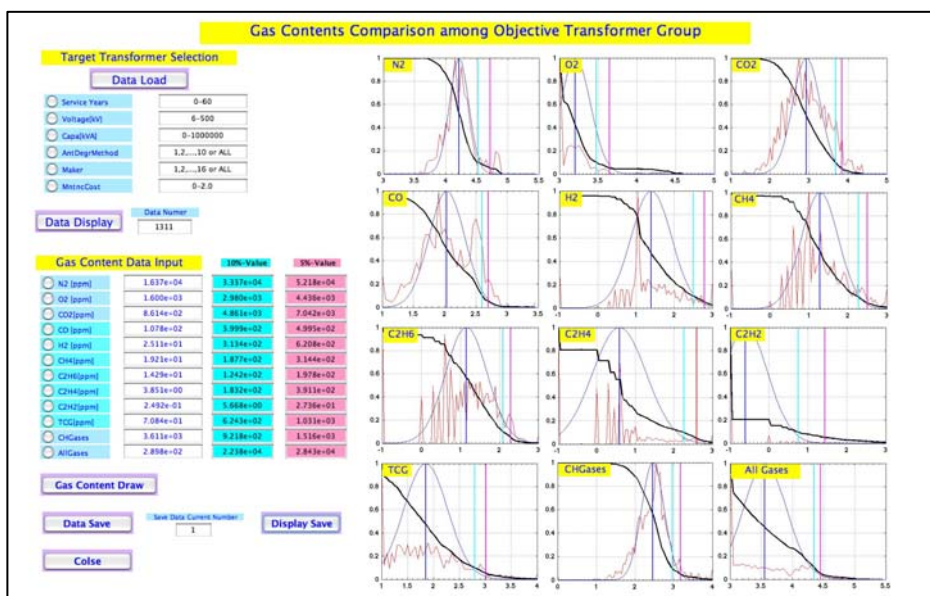
A support program for the evaluation of dissolved gas analysis (DGA) has been developed. It provides comparison with data obtained from the same kind of transformers, and gives criteria among them (Fig.1).

(2) Decision support tool based on average maintenance cost

Support programs to evaluate the average annual maintenance cost have been developed. These program can provide an optimum overhaul strategy by considering the overhaul effect (Fig.2).

## Future Developments

Support programs for maintenance and renewal strategy by considering individual characteristics of equipment are being investigated.

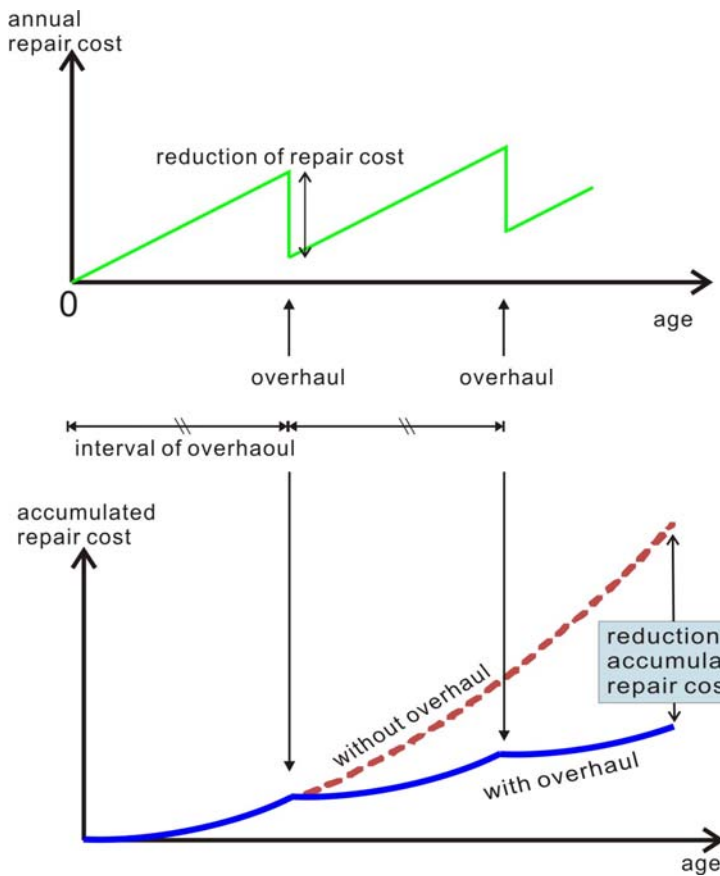


(An example of display)

### DGA data analysis and comparison program

The program can analyze and display the distribution densities of 9 gases (and their accumulation). The raw data, a fitted curve with a normal distribution, and the cumulative normal distribution are plotted. Criteria, such as the 5% line and 10% line, are also indicated. As evaluation support, new data are compared with these criteria.

Fig. 1: Display of Dissolved Gas Analysis data analysis tool



### Concept

The annual repair cost is assumed to increase proportionally with age, and decrease by an overhaul. In this case, the accumulated repair cost changes with and without overhaul, as shown in left figure (Only repair cost is illustrated; Overhaul cost is also considered in the program). Overhaul strategy is examined by changing its period and scale. Expected failure cost increasing by age is also considered in the same way.

### Necessary parameters

Following data are required: ① increasing rate of annual repair cost, ② overhaul effect (relation between overhaul cost and reduction of annual repair cost), ③ mean lifetime and cost at failure (for evaluating expected failure cost according to age), ④ expected operation term (evaluation term). They should be obtained from actual data, if possible (the objective of this research is to provide programs, which equipped input frames for necessary and sufficient parameters).

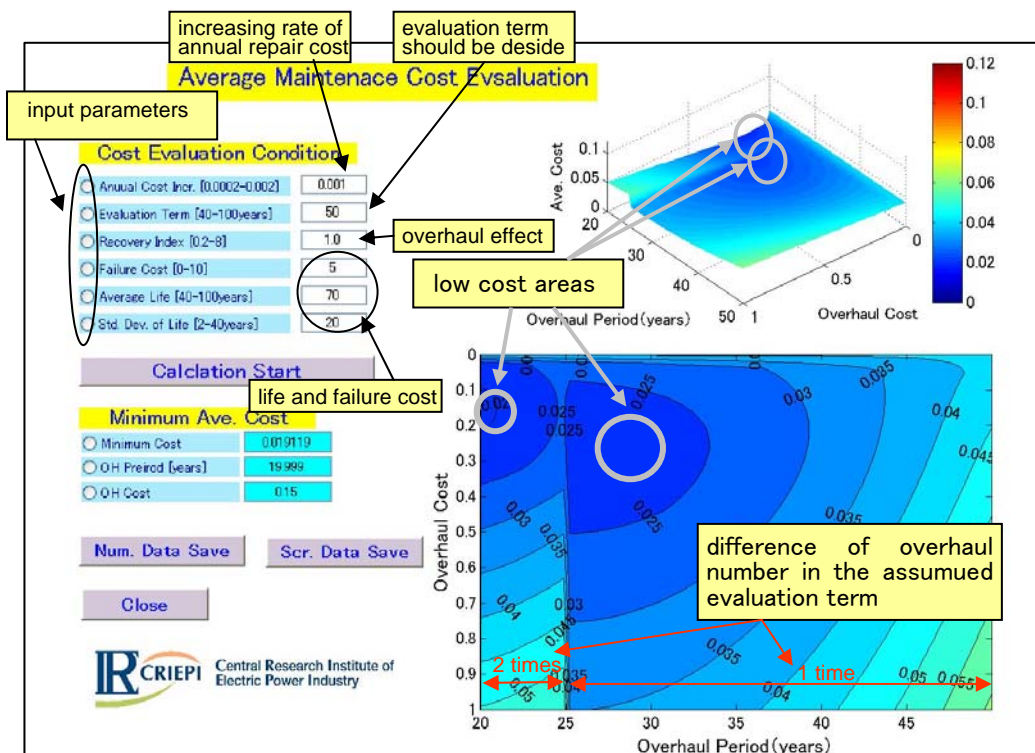


Fig. 2: Display of average annual maintenance cost evaluation program