Entropy Weight Health Index Method of Power Transformer Condition Assessment

Abstract — **Evaluate power transformer's operating status correctly is a key issue to its reliable working and the maintenance policy. The Health Index (HI) represents a practical tool that provides the overall health of the asset, among which reasonably determine the weight of each index is the key to guarantee the quality evaluation. While in the current weight determination process, the method of professor's weighting to define the weight of parameter is generally employed, but in the use of the method, owing to the difference of different professors' experiment or the angle which they view the problem, they will come to different conclusions at one parameter of evaluation, they even make subjective judgment. In this paper, we come up with the entropy weighting method that determines weight by judge-matrix which is made of the index value of all cases, and uses entropy of the parameter to define its entropy weight. This method presents subjective judgment in the weight determination process, and makes the process fairer and more scientific. Entropy Weight Health Index(EWHI) method determines the weight of index according to its relative degree of change that impact on equipment, it can be used to compare health status of different time and to get the succession trend for transformer condition in order to provide basis for condition based maintenance.**

Keywords — powe transformer; condition assessment; entropy; entropy weight; health index

I. INTRODUCTION

Power transformer in grid is the core of energy transmission and it is also one of the most expensive electrical equipment. Power transformers have the single highest value of the equipment installed in high-voltage substations, comprising up to 60% of total investment. The quality of transformer's performance will have a direct impact on the security and stable operation of power system. Thus, improving the operating reliability of power transformers is of great significance to the power grid[1]. An increasing demand for improved financial and technical performance has pushed most power utilities to assess the actual condition of their transformers. To achieve the optimal balance among capital investments, asset maintenance costs, and operating performance, there is a need to provide economic and technical justifications for engineering decisions and capital replacement plans.

Health index is a practical tool that provides the overall health of the asset, in application of health index method to evaluate transformer condition, reasonably determine the weight of each parameter is the key to guarantee the quality evaluation [2]. While in the current weight determination process, the method of professor's weighting to define the weight of parameter is generally employed, but in the use of the method, owing to the difference of the different professors' experiment or the angle which they view the problem, they will come to different conclusions at one parameter of evaluation, they even make subjective judgment.

In this paper, we combine entropy weight method and health index together, and use entropy weight health index to assess the status of power transformer. Entropy weight method defines the entropy of the parameter by the judge-matrix which is made of the index value of all cases, and uses the Entropy of the parameter to define Entropy weight [3]. This method presents subjective judgment in weight determination process, and makes the process fairer and more scientific, moreover, it solves the problem existed in current fixed weight, as fixed subjective weighting methods cannot fully reflect equipment's condition change over time, and will weaken the information when some condition parameters degrade rapidly, however, these parameters are always the most important. Entropy weighting method can reveal the changing trend of condition parameter pretty well, providing the basis for further diagnosis and decision-making of equipment maintenance.

Finally, we apply entropy weighting method in comprehensive status evaluation of a power transformer of the ultrahigh voltage bureau of Baoding, and achieve satisfactory result. Combining the characteristics of entropy weighting method and the given case, we can get the conclusion that the evaluating mode presented in this paper is maneuverable and has broad application value.

II. BASIC PRINCIPLE OF ENTROPY WEIGHT METHOD

Entropy method is the concept of thermodynamics, which was first introduced by Shannon into the information theory, and now is widely used in the engineering, socio-

978-1-61284-666-8/11$26.00