Ageing asset populations pose a considerable challenge for utilities, aged assets must be replaced optimally so that sufficient levels of system reliability are maintained and costs minimised. However, service age alone cannot serve as the suitable indicator of reliability.

In order to determine replacement priority a condition-based approach is adopted, in which assets are categorised according to a set of discrete indices called Asset Health Indices (AHI).

Derivation of transformer replacement priority from both asset health index and perceived system criticality can be greatly refined using detailed knowledge of transformer failure modes (common mode, sympathetic and hidden failures).

The availability of such a methodology will ensure an optimum and justifiable prioritisation of transformer replacement.

This project is aimed to investigate the life expectancy of transmission power transformer in the UK from three aspects: statistical analysis on historic transformer life data, thermal modelling of in-service transformers, and through the transformers’ furan measurements. It is also aimed to link transformer ageing and condition with system network reliability and develop transformer reliability and life models under system events such as overloading, short-circuits and lightning strikes.

**Ageing Transformer Population:**

Many of the transformers in the UK transmission network were installed during the post world-war economic boom in the 1960's. At the time of installation it was estimated that these assets would remain in service for approximately 40 years. However many of these units still remain in service today and are now approaching or have surpassed their expected lifetime.
**Project:** Transformer Lifetime Modelling and Asset Management

**Transformer Lifetime Modelling:**

The life of insulating paper is regarded as the ultimate life of a transformer, therefore a review of the thermal model published by the IEC transformer loading guide 60076-7 has been made and its use extended to estimate a transformer’s thermal lifetime. The model is improved from two aspects, first Arrhenius equation is adopted to take into account of practical ageing mechanisms of oxidation and hydrolysis when calculating the paper’s ageing rate, and the model also takes the paper’s moisture accumulation effect into consideration. The model is further refined by using measured DP value obtained from scrapped transformers.

**Asset Health Index (AHI):**

The condition of a transformer can be characterised using the Asset Health Index (AHI). The AHI reflects the current condition of the dielectric, thermal and mechanical properties of the transformer. It is derived from the results of a series of routine tests performed on the transformer and knowledge of transformers of a similar design. Based on this information, an AHI can be assigned ranging from 1 (worst) to 4 (best).

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