ACTUAL MAXIMUM CYCLIC CAPACITY OF INDIVIDUAL TRANSFORMERS

One aspect of the operation of a transformer that is of particular interest to the owner is the upper loading limit or the amount of Power (in MVA) the transformer can supply within safe operating limits.

If new load is being proposed there can be situations where the firm capacity of the substation is reached when the load on the substation equals the capacity of one of the transformers when one is out of service. If the capacity of the transformers can be shown to be above the nameplate rating or the rating given by loading guides then it may be possible to defer substation reinforcement.

Also, it would be advantageous to be able to generate reliable data regarding the upper loading limits of transformers to support network management decisions both in terms of short term outages and planning for future load growth.

The aim of this technique is to generate reliable loading data without impacting on the operation of the transformer itself. This technique developed by EA Technology is completely non-intrusive and only relies on data that is readily available and gathered easily. It is also suitable for use on any bulk oil transformer from any manufacturer.

The EA Technology system is based on monitoring a number of transformer parameters; the winding temperature, system voltage, load current, external ambient temperature, the operation of the fans and pumps and wind speed whilst the transformer is energised. These parameters are monitored every second and the data is averaged over one minute period for a fixed period of time (typically two weeks), during which the load needs to be sufficient to bring the cooling fans and pumps into operation. Within substations with two transformers, it is often possible to switch the load from one transformer to another to increase the load causing the cooling system to operate.

When sufficient data has been gathered, a thermodynamic model of the transformer is created using a computer program to amend the various coefficients to produce the best fit possible between the predicted and measured winding temperatures. It is vital to increase the load to a sufficient level to gain an accurate thermodynamic model.

Once a satisfactory model has been produced, the load curve is scaled up to determine the maximum load that can be supplied by the transformer whilst maintaining the hot-spot temperature within a specified limit.

The system allows the user to gain insight into the upper limits of transformer loading and should enable an assessment of large transformer safe loading limits in an easy and efficient manner.

The motivation for undertaking this project was the concern regarding the increasing population of older transformers and a recognition that more information was required from the existing population to assist with planning and asset renewal decisions. This concern is as pressing as ever in 2009 and it is hoped that the system can be widely used to develop greater confidence in the results and to build up a bank of experience over time.