Leverage ABB’s vast transformer design and manufacturing experience to help identify the condition of critical assets, determine actions that lower risk and improve transformer health, reduce maintenance costs and extend transformer life. Fleet assessments provide optimal asset management that can help avoid unnecessary and potentially catastrophic emergencies.

Background
Because of the enormous number of transformers installed between the 1950’s and through the 1970’s, a large number of transformers on the grid are more than 40 years old. Statistics show that the average age of installed power transformers in the US is over 40 years, and transformer failure rates are increasing. A failure peak is expected to occur towards the end of the 2010 decade according to Green Tech Media (http://www.greentechmedia.com).

Due to the long service life of these aging assets, many transformer operators do not have complete maintenance records. Many maintenance activities are performed on a time based or reactive schedule. True condition based maintenance will reduce maintenance costs and time significantly. When utilities transition to condition based maintenance, a complete assessment of the entire fleet is needed of the existing fleet. Efficient assessments can recommend maintenance actions and strategies to extend transformer life, lower the risk of failure and use advanced diagnostics to augment missing data.

Challenges
Some of the challenges necessitating an accurate analysis of the transformer fleet to create an effective maintenance plan include:
- Aging infrastructure - The average age of a power transformer in service is now more than 40 years.
- Aging workforce - Owners are potentially at a huge disadvantage in losing knowledgeable and expert maintenance crews due to the high retirement rates currently seen in our society.
- High transformer cost - Transformers themselves are very costly and they are also very costly to replace.

- Grid capacity and complexity - As more and more elements get added to the grid, transformers are placed under greater stress and have to be able to handle those additional loads.

ABB’s Mature Transformer Management Program (MTMProgram™ ) provides valuable fleet information
A true assessment of a transformer fleet considers much more than the chronological age of a transformer. MTMProgram™ provides a consistent methodology for assessing all transformer assets individually. The assessment considers all factors that impact the life of a transformer including, but not limited to, condition, design, failure history, loading, maintenance, operating environment and fault exposure.

An accurate fleet assessment helps equipment and asset managers to decide on an effective and low cost maintenance strategy and to define the associated maintenance and replacement budget. Based on the condition of that transformer and its role in the grid, the program identifies units that require priority on the maintenance schedule and activities that may improve reliability.

MTMProgram™ uses a four step program to assess transformer health and reliability.
1) Fleet Assessment - In this phase, analytical and statistical information about each transformer in the fleet is gathered and processed. Conditions from each transformer are then grouped into five different risk categories, as illustrated in the following figure. It is important that each condition be grouped so that any accumulative effects may be considered for each of the five risk categories.

![Fleet Screening Diagram]
Conditions are grouped into different risk categories to find the total risk of failure. Each transformer is then individually categorized into one of three categories (normal, priority and urgent) based upon the calculated risk of failure. Normal assets require only standard maintenance procedures, priority assets require action to extend the transformer life or reduce the damaging effects of a failure and urgent assets have the highest risk of failure and require immediate action to lower system impact.

2) Transformer design and condition assessment – For transformers identified as the highest risk of failure during the fleet screening, ABB employs a structured protocol developed by transformer design and operations experts to more thoroughly evaluate the condition of the individual transformer. This assessment combines input from the transformer design, historical data, operating history, ambient conditions and routine and advance diagnostic data.

With thorough data, analysis and on-site inspection, an accurate TROF (Total Risk Of Failure) is calculated, then necessary and value increasing maintenance practices are recommended. Shown here is the TROF for a single transformer among the entire fleet.

3) Life profiling – By applying the results obtained from the assessments, appropriate actions are identified. A life evaluation can be done to confirm that appropriate actions are cost justified based on the remaining life of the transformer. Additionally, the MTMProgram™ provides information for the end user to develop a solid contingency plan that can determine return to service options for the high-risk units, ensuring effective failure management.

4) Implementation – The recommended actions can be implemented to achieve risk reduction, life extension and an overall health improvement of the fleet. Typical solutions include combinations of preventative and corrective maintenance, field repairs, retrofits, relocations, replacements, testing and advancing diagnostics and factory repairs or remanufacturing.

ABB offering
Transformer failures are inevitable but having an accurate condition evaluation of your transformer fleet allows the development of a protocol aimed at extending transformer life and minimizing the impact of a failure. ABB’s MTMProgram™ can provide the baseline for all future maintenance and equipment replacement actions to ensure the highest reliability possible.

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