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An Analysis of Power Transformer Outages and Reliability Monitoring

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Abstract

Power transformers play an important and significant role in the power system to connecting the subsystems and delivering the electricity to consumers. Power transformers are one of the most expensive elements in the power system, so focus on their status of parameters is the primary task. The reliability assessment and efficiency of the transformers have a major impact on the security. The power transformers constantly subjected to failures in its components, and their effect is interruptions of consumer's supply and reliability. So, methodology related to reliability assessment of power transformers includes; monitoring of operation status, type of failures, forced outages and interruption time. The study includes; type of failures, reliability and condition assessment based on statistical data monitoring during the years in the Power Transmission System of Kosovo.

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Keywords: Failures; monitoring; outages; power transformers; reliability; security;

1. Introduction

Transformers except consumer supply have an important role in the electrical power system configuration and topology influence. So, they have a significant role starting from nodes when are connected consumers, generator units, the topology of transmission and distribution network. Transformers are most important to power system security and reliability, as well as is reflected in the optimization of electrical network and voltage quality.

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Security and reliability of power transformers is described based on some of the conditions, such as; transmission limits, contingency analysis, voltage stability, load shedding, security criteria and effect of failures [1].

Nomenclature

CT	Current transformer
ENTSO-E	Electricity Network Transmission System Operator of Europe
KOSTT	Kosovo Operator System Transmission and Trade of Kosovo
S.C	Short Circuit
VT	Voltage transformer

2. Transformer outages and failures

Transformer failure can occur as a result of different causes and conditions. Mostly can be classified as; electrically, mechanically and thermal [2]. A failure is any inability of a part or equipment to carry out its specified function. Most failures may be separated into two category types: Internal and External [3]. So, monitoring is the observation of transformer conditions [4]. Continuous monitoring of parameter characteristics has become an important task to avoid deterioration of their parameters such as; electric, thermal and mechanical under working condition [5]. In the paper, the failure model of transformer is based on annual statistics [6]. Transformer outages are discussed at 110 kV to 400 kV levels, including 76 power transformers ranging from 20 MVA to 400 MVA to 36 substations. Fig. 1 shows the types of power transformer failures in the Transmission System Operator - KOSTT, for the period 2013-2016.

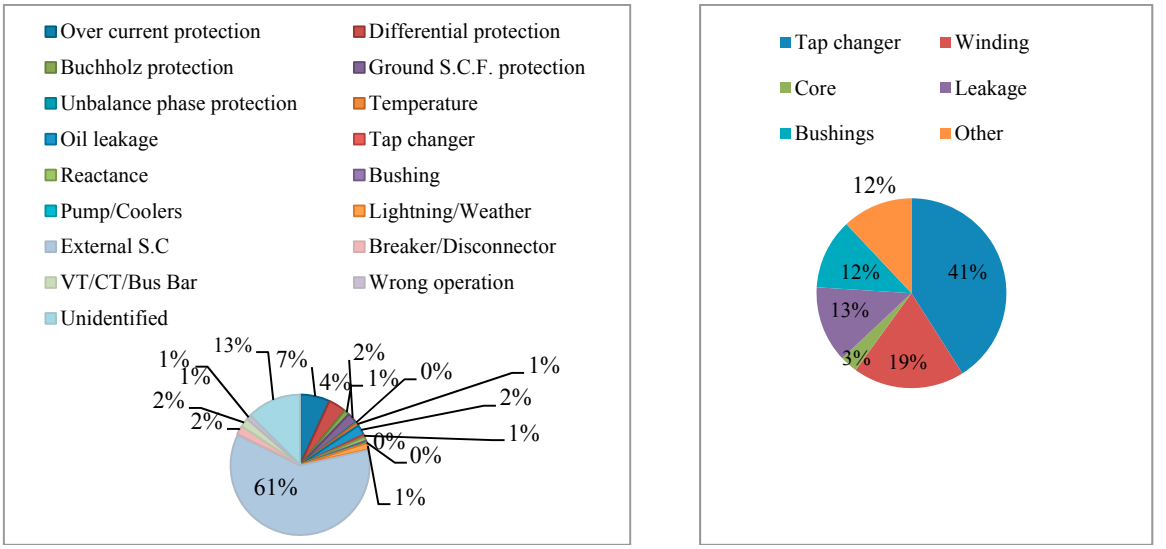

Fig. 1. Outage indicators of power transformers (a) types of power transformers outages (20 – 400 MVA) in the KOSTT; (b) failure data based on CIGRE report.

As shown in Fig. 1 it should be noted that the external short circuit from the distribution system includes about 61% of the outages, while 7% are caused by over current, as well as from the defects in the bus bars, VT, CT that includes 4% of the outages, but is noted that a 13% percentage of outages is unidentified. The study shows the outages of the respective transformers (Fig. 2).

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