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Techniques to increase efficiency of transformers--------A review

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Abstract: Power system network consists of many useful devices. To increase the energy efficiency we need to increase the efficiency of devices.Transformer is one of the vital parts in electrical power system network. Transformer has also great importance in designing different electronics based devices. As today the fuel sources declining day by day, it is very much necessary to save energy. As transformer has large applications in power system networks as well as electronics devices its efficiency is very vital. Different researches are going on all over the world to increase the efficiency of useful devices. This paper describes some important aspect of different devices to increase their efficiency.

Key words: Transformer, efficiency, power,quality, network,cooling,flux, core, design,Insulation, electrical, electronic devices, rectifier circuit,current, cost,optimisation

Introduction: Design aspect has a very vital influence on the performance based parameters of any electrical, electronic and electromechanical devices. The efficiency rate is one of the basic parameters that a transformer must comply in order to be sold in the market [1]. There are lots of parameters on which efficiency is dependent. We should keep in mind that increment of energy efficiency would increase the cost also. So we have to be optimised. We cannot compromise with the power quality services also. Over the past decades, both global population and world energy consumption have been steadily increasing, causing, among other things, an increment in electricity prices [2].

Methodology: There are lots of parameters on which the transformer core has a great impact on its efficiency. This paper [3] describes the fact more efficiently.Researchers try to find out possible optimum solution for optimisation of energy cost and quality of power to be transmitted. Also our aim is to supply power at low cost so that all can have access of very basic needs 'electricity'.Longer distribution lines associated with higher loads are the causes of higher line losses [4].

Distribution transformer is one of the vital parts in power system network. This paper [5] describes the efficiency of distributed transformer through different tables and figures. Through different parameters and data the paper shows how efficiency of distributed transformer increases. In some devices where dc power is needed transformer along with rectifier circuit is also needed. DC power quality is equally important in running devices. Rectifier circuit converts an ac power supply to dc power supply. While converting an ac power supply to dc power supply voltage, power, and current all these parameters have its importance in their own area. Ripples may come in signals which may cause unwanted heating, signal distortion in the final dc signals. For very accurate communication circuits

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small ripples may cause data losses, misinterpretation in the receiving network. This paper [6] deals with the transformer rectifier circuit for some specific purposes. Increment of power in different climate, weather varies from time to time. The requirement of power may also changes during festival time.Overloaded electrical systems are a major source of unreliable power [7].So we have to keep in mind that during overloaded condition also the efficiency of the transformer should maintain an optimal value.Different regulatory bodies present in different countries for testing different electrical, electronic devices. Power transformer covers a major portion of power system network. Power transformer efficiency measurements are a crucial part of the acceptance tests of a power transformer [8].In transformer residue flux plays a vital role. Residue flux, core design, material has effect on transformer efficiency parameter. Thus it is our conclusion that the isolation, diversionary and the delaying approaches which will act as high current surge inhibitors be implored and effected at the primary windings of the transformers using described techniques [9]. Different researchers used different methods for improving the efficiency of different kinds of transformer. Transformer insulation is also a very vital part of transformer. In power system insulation failure can lead to total power system failure. Good insulation leads to reliability of the total power system. Insulation is directly related to safety of the engineers and workers, working in power stations, electrical supply. Insulation is also required for the domestic users and nearby animals also. Insulation increases life time of the system appliances. This paper [10] gives a good idea regarding the improvement of efficiency of transformer.

Designing of any electrical devices is most vital part of the device. Core material, no of turns, its rating,and its uses in proper places is extremely important. Temperature is also a very vital parameter to be cared. While designing any electrical, electronic appliances we must keep in mind regarding these issues. Additional losses in transformers due to harmonic distortion cause further heating in their structural parts, and damage their suitable operation, thereby reducing their lifetime [11].Estimating loading per cent of a distribution transformer and energy loss during power transformation for a continuous process industry having High Tension (HT) to Low Tension (LT) power conversion in its distribution is an imperative for the betterment of energy efficiency [12]. The efficiency of a transformer has a significant relationship with electrical loads attached with the transformer. Losses in a transformer have a relationship with connected loads. This paper [13] gives a modelling of transformer parameters with load. One major reason for damaging of any electrical, electronic devices is production of excessive amount of heat. While designing any electrical, electronic devices the designer should keep in mind the proper cooling system. Proper cooling system protects the device from excessive rice in temperature. The designer must improve the design to increase the energy efficiency of the devices. The designer should also pay attention to improve its life span. Because in electrical or electronics based systems all the devices are interlinked with the other available devices of the system. So if one device becomes very hot the heat may flow in the other healthy device. So if this process continues there may be a total collapse of the system due to unwanted heat flow in the system. So for any electrical or electronics based systems proper cooling system design is required. This paper [14] describes about the efficiency and cooling system of transformer.. Electrical and electronics devices efficiency can also be increased by adding other devices. Additional devices may increase the cost of the appliances. So we have to keep in mind regarding the cost factor also. One way to

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increase the efficiency of transformer can also be achieved by adding other devices also. This paper [15] uses some extra devices for increment of efficiency of transformer. Increment of efficiency as well as controlling the electrical, electronic devices is also a vital job. This is also applicable in the case of transformer also. This paper [16] gives an idea regarding this. Design of any system is most vital part in any engineering application. We need to improve the system efficiency without compromising with the output, efficiency of the system. Design of any electrical, electronic devices is an art. It is the best part for any engineering system design is to reduce cost and get maximum output. Design of transformer is also an important aspect in power system engineering. This paper [17] gives an idea regarding this concepts based on transformer modelling. Optimisation technique is the most acceptable technique in any engineering division. The need for electrical, electronic devices increases rapidly during recent years. To keep pace with the increasing demands the need for optimisation technique increases. This paper [18] on optimisation in the design of transformer discusses it. Different techniques, use of different materials can have a significant effect over the efficiency of a transformer. This paper [19] discusses regarding those issues. In industry many electronics, electrical devices are in use. So the industry consumes large portion of electrical energy. It is one important, costly part in the production, manufacturing process. Every industry try to minimize the production cost as far as possible. Transformer is frequently used in industry. This paper [20] discussesthis.In industry heat generation is a common effect. But in industry heat is also required for different activities. To utilize the already generated heat by different units of an industry may increase the overall efficiency of the system performance. Transformer also generates heat. In large power system network many transformers are in use. This paper [21] enlightens these issues. In large power system network faults may occur due to many reasons. One major reason is proper voltage distribution among the system parameters. Due to improper distribution of voltage may reduce the life of connected devices. Transformer plays most vital role in overall voltage distribution of a network. So proper balancing in terms of voltage is required. This increases the overall efficiency of the power system network. This paper [22] discusses regarding this issue in practical uses. Noise is a very critical problem in any electrical or electronics based system. Depending upon the requirement of noise magnitude noise eliminator is required. To eliminate noise we need to use different auxiliary equipment with the device which produces noise in the network. This paper [23] discusses this issue based on transformer. Application of power electronics in industry are a common practice. Using power electronics devices we can solve many industrial complex problems in suitable way. This paper [24] discusses this issue based on transformer to improve its efficiency. Application of electronics devices in today's world is very popular. There are lots of advantages of electronic devices. This paper [25] discusses regarding this to improve the efficiency of transformer. Use of some different types of materials can also have a good impact on the efficiency of transformer. This paper [26] enlightened this issue with application of piezoelectric in transformer. This paper discusses this issue related to efficiency of transformer. This paper shows both simulation as well as physical experiment to enlightened this issue related to efficiency and optimization of transformer. Using different core materials the transformer efficiency can be increased. The designer should make the design in such a way that the losses in a transformer can be reduced. This paper [27] discusses this issue with Amorphous core transformers.The objective of the electrical engineers is to supply

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continuous power without any interruption. But different factors are there. Every system has its limitations. Transformer has also its limitations. We have to monitor different parameters of the transformers in regular intervals. This have impact on the efficiency of transformer. This paper [28] deals with these issues. There are some specific applications of each electrical and electronic appliances. So for each type of specific application there may be specific techniques for increasing the efficiency. This paper [29] enlightened techniques to increase the efficiency of specific application of a transformer used in aircraft using hybrid magnetic core. Space optimization is a technique to improve the acceptance of a design. As now a days space saving is also a factor in different electrical and electronics design. Transformer consists of many parts. So to reduce its size is also a challenging work. We must have to maintain a balance between the size and efficiency of any transformer. This paper [30] enlightened this issue. In some significant application we need some special sophisticated device. Sometimes the utility of those devices may depend on some other devices attached with the system. This paper [31] enlightened this issue in case of a super capacitor application. In large integrated systems many electrical and electronics devices are in use. In power system network which is a very vast network system consists of multiple no of transformers. The efficiency of a particular transformer may depend upon the efficiency of some other transformer used in the system. This paper [32] deals with this issue.

Conclusion: Based on the above analysis of different electrical properties of transformer which have impact on efficiency we see that each parameter has its own significance. Depending upon the application requirements we have to choose the corresponding method for best possible efficiency. Improving efficiency is most vital part of transformer, but power quality improvement is also very much important. So we have to maintain a balance between efficiency and power quality. Our main objective is to deliver good quality power at optimum cost. As transformersare frequently used in electrical and electronics engineering it is of great importance.

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