ADIABATIC POWER GENERATION IN A TRANSFORMER BY USING A LIQUID AMMONIUM CHEMICAL RODS

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Abstract—*Power (Energy) is the indispensable requisite for the economic development of a country. The contemporary society is so much reliant upon the use of electrical energy that it has become apart and parcel of our life. Almost many functions will be arrested when the supply of energy stops. Due to lot of demand for electrical need several alternative power generation mechanism are established through solar, wind and biomass. This project presents one of the alternate power generation using adiabatic mechanisms in transformers. A transformer is an apparatus for converting electrical power in an ac system at one voltage or current into electrical power at some other voltage or current. During this conversion process lot of heat emits. A significant amount of energy in transformer is rejected as waste heat to ambient. The heat loses is up to 30% or more. By converting waste heat into electrical power would be convenient and effective for a number of primary and secondary applications. The primary aim of this project is to generate electrical energy from the waste heat dissipated by the transformer during its operation. The waste heat dissipated during the transformer operation is absorbed using chemical rod where liquid ammonium is used to convert the heat into ammonium vapour. This vapour forms the basic requirement of electrical power generation through turbine. Finally the turbine is coupled to generator for generating the electricity. The generated power supply can be used to run all electrical home appliances.*

Keywords—transformer, temperature sensor, generator

1. INTRODUCTION

EFFICIENCY OF ENERGY CONVERSION [1] - by sustained energy strategy, the theme of the paper is, they discuss about the energy efficiency while converting one form energy to other form. In this paper, they follow two laws based on energy conversion. Based on these two laws the various device efficiency is calculated and various conversion systems.

THERMAL TO ELECTRIC ENERGY CONVERSION [2] - In this paper the researcher discuss about the basis of thermal energy to electric energy conversion. And also discuss about the how efficiently thermal energy is converted into electrical energy. The efficient conversion is based on Carnot limit and entropy.

HEATING WITH ELECTRICITY [3] - Produced by the Natural Resources Canada's Office of Energy Efficiency Energy Guide In this paper, the developers discuss about steps involved in heating with electricity, the Four-step Decision-making Process for Home Heating, Basic Equipment for Electric Heating Systems, and comparing the annual heating cost and accommodating the electric load, This are all discussed in this papers.

OVERVIEW OF THERMOELECTRIC POWER GENERATION TECHNOLOGIES IN JAPAN [4] -In this paper they deals with waste heat recovery and renewable heat source. Waste heat from industrial furnace, solid waste, motor cycle and automobiles. Renewable energy such as solar thermal energy and geothermal energy. These are all discuss in this paper for waste heat recovery in japan as thermo electric power generation.

THERMOELECTRIC GENERATOR [5] - In this paper, they designed arrangement for given electricity as output and heat as an input. And the heat taken from burning of fuel then that heat is used as source depending upon the temperature of the water the output is generated. They used thermoelectric generator for getting the output. This is the arrangement is made in this report.

TRANSFORMERS TYPES [6] - In this paper, the several types of transformer are discussed. The various types of power transformer and instrument transformer are mentioned in this paper. The various types testing and cooling system are analyzed in this paper.

OCEAN THERMAL ENERGY CONVERSION [7] - The warm seawater is used to produce a vapour that acts as a working fluid to drive turbines. The cold water is used to condense the vapour and ensure the vapour pressure difference drives the turbine. OTEC technologies are differentiated by the working fluids that can be used. Open Cycle OTEC uses seawater as the working fluid, Closed Cycle OTEC uses mostly ammonia.

EFFECTIVE CONVERSION OF TRANSFORMER LOSSES INTO DISSIPATED HEAT [8] - There are many losses that occur during the functioning of a transformer which in turn causes heat generation. This heat, if not dissipated properly causes a lot of metallurgical problems in the transformer. The paper also explains the electrical parameter which if controlled during operation will in turn reduces the heat produced and helps to increase the transformer life. ANALYSIS OF OCEAN THERMAL ENERGY CONVERSION POWER PLANT USING ISOBUTANE AS THE WORKING FLUID [9] - This paper will cover concept, process, energy calculations, cost factoids and environmental aspects. The exhaust vapor is condensed afterwards, using the cold deeper ocean water, and pumped to a heat exchanger to complete a cycle.

INDIAN OCEAN THERMAL ENERGY [10] - In this ocean thermal energy conversion process solar radian to electric power. In this plant cold water and warm water are used to the process. Ocean is a vast renewable resource with the potential to help us produced billion watt of electricity, it can also supply quantities of cold water as a byproduct.

ENERGY ANALYSIS OF THERMAL POWER PLANT [11] - Energy analysis helps designers to find ways to improve the performance of a system in a many way. The energy losses from individual components in the plant is calculated based on these operating conditions to determine the true system losses.

DESIGN OF SENSOR SYSTEM FOR DETECTION OF HEAT GENERATED FROM TRANSFORMER [12] - In this paper electrical components which is used to supply, transmit and use electric power and Load variations affect the working of transformer. In the transformer heat is generated due to different types of losses i.e., load losses and no load losses. These losses then converted in the heat and hence rising the temperature of the windings, core, oil and the tank of transformer. This paper are carried out analyze the increase in ambient temperature of power system with various range of load impedance connected to it

POWER TRANSFORMER WINDING THERMAL ANALYSIS CONSIDERING LOAD CONDITIONS AND TYPE OF OIL [13] - In this paper Power transformer outages have a considerable economic impact on the operation of an electrical network. The heat and an accurate computation of the hottest spot temperature (HST) helps in a realistic estimation of the reliability and remaining life of the transformer winding insulation. Oil in the transformer is assumed nearly incompressible and oil parameters such as thermal conductivity, special heat, viscosity, and density vary with temperature.

A NEW THERMAL MODELING OF DRY TYPE TRANSFORMER AND ESTIMATING TEMPERATURE [14] - Temperature rise in a transformer depends on ambient temperature, output current and type of the core. Considering these parameters, temperature rise estimation is still complicated procedure. They will present a new model based on temperature rise. This method avoids the complication associated to accurate estimation and is in very good agreement with practice. The usefulness of thermal model is to estimate the highest temperature transformer experiences during its functioning (the hot spot), so that relative ageing rate can be evaluated.

A transformer is an apparatus which is deployed for converting electrical power in an AC system at one voltage are current into electrical power at some other voltage are current without use of rotating parts. In transformer the core is made up of laminated core construction which minimizes the iron loss and core loss. There are two types construction of transformer they are core type and shell type transformer. Based on the winding they are three types step-up transformer, step-down transformer and idle transformer but these entire transformer have one major problem that is loss of I2R and Eddy current loss. The major transformer loss is heat loss that heat loss of the transformer is reduced by several cooling methods they are: Self air-cooled (dry type)

- Air blast-cooled (dry type)
- Liquid-immersed, self cool
- Oil-immersed, combination self cooled and air blast
- Oil-immersed water-cooled
- Oil-immersed force oil-cooled
- Oil-immersed combination self cooled and water cooled

The above mentioned are the cooling methods used in the transformer to reduce heat. But in this project a new cooling method called chemically cooled method is deployed.

The circuit is design with a cooling rod that protects transformer as well as generate electricity using this chemically treated rod. Through the rod the liquid ammonium is made to flow which acts as coolant as well as converter in the generation of electrical power.

First the transformer heat is sensed by the temperature sensor then the protecting rod is placed in the transformer through which a chemical called Liquid Ammonium is made to flow which reduces the boiling point of the heat developed in the transformer as well as generate vapor to rotate the turbine coupled to electric generator. The ammonium vapor is then cooled by the coolant that may be water that condense ammonium vapor into ammonium liquid using the pumps the mechanism is recycled to generate electricity.

Reaction

•Liquid Ammonium + Heat Absorbed → Ammonium Vapor

Ammonium Vapor + Heat Emission → Liquid Ammonium

•These two endothermic and exothermic reactions takes place in this method for cooling the transformer and also generate electricity.

•On the other hand the heat is absorbed by PIEZO electric transducer the output is amplified then given to the load.

2. BLOCK DIAGRAM

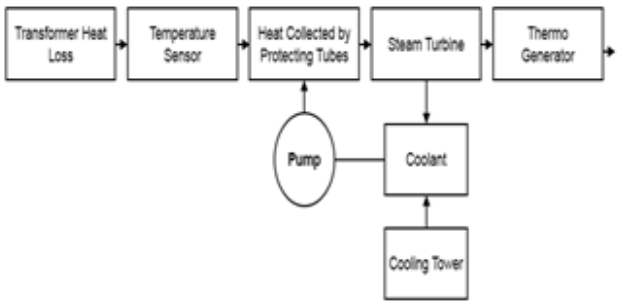

Fig.2. proposed methodology

The component requirements and flow of operation of this research is shown in the block diagram. The block diagram represents the conversion of transformer heat energy to electricity energy. The transformer heat is absorbed by cooling rod or protecting rod. In that protecting road a chemical called liquid ammonium is made to flow. This

liquid ammonium absorbs the heat and endothermic reactions take place. Due to this, liquid ammonium is converted to vapor ammonium that vapor ammonium is sufficient to rotate the turbine that is coupled with generator. After that the vapor is allowed to cool using water to convert vapor into ammonium liquid using pump. This process is recycled repeating the conversion process. This reaction leads to the generation of electricity.

3. Internal Block Diagram

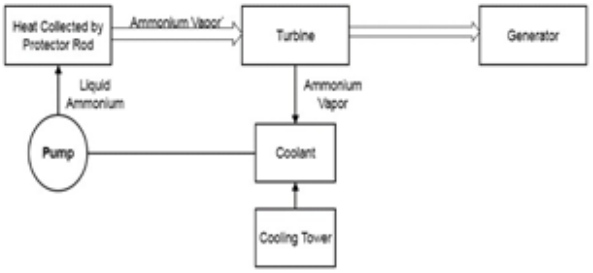

Fig.1. internal block diagram

4. Methodology

Two type of process involved during transformer operation. They are emission and absorption. In conventional approach the heat generated in the transformer are cooled using various oil based mechanism. This process is expensive, cannot be recycled and got reliability issues. To overcome these shortfalls instead of cooling oil, liquid ammonium is used to absorb the heat. Through two mechanisms the power can be generated. The former one defines the generation of electricity using ammonium liquid. Here the heat is absorbed and reacted with ammonium liquid to convert to vapor.

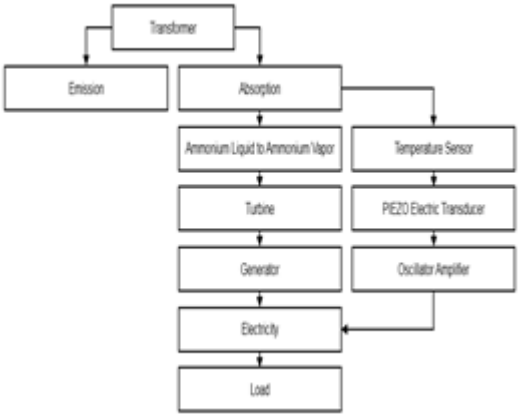

Fig.3.functional layout diagram

This steam or vapor is given to turbine and the generator produces the electricity. Due to endothermic reaction the liquid ammonium converted into ammonium vapor that sufficient to operate turbine to produce electricity. Finally this is given to load. The latter one defines the generation of power using temperature sensor.

Justification

The project entitled “Adiabatic Power Generation In Transformer Operation Using Liquid Ammonium Chemical Rod” will have immense pragmatic social relevance, significance and alertness to the society. This project produces fruitful result in generating electricity due to adiabatic logic where the waste heat is converted into useful energy. More specifically, in a growing power starved society, we need to use devices which can conserve energy. The proposed project would directly satisfy this desire of the society.

5. Conclusion

The project work entitled “A novel reversible power generation in a transformer for MTPS operation” will have immense pragmatic social relevance and significance. Now a day’s power generation is one of the main indispensable requirements of a country. Power or Energy became a major resource in the development of the society. This is the main reason for finding new trends in power generation. The existence and development of adequate infrastructure is essential for sustained growth of the Indian economy. This project produces fruitful result in generating electricity an alternate source of power generation using adiabatic logic where the waste heat is converted into useful energy. More specifically, in a growing power starved society, we need to use devices which can conserve energy. The proposed project would directly satisfy this desire of the society.

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