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Energy Optimization of Industrial Drive at Sanjivani Sugar Factory

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Abstract: *In the present day world, energy conservation by a small means plays a significant role in making huge profits for any industry. The need of improving energy efficiency and particularly in motors. In industries, motor driven systems represents about 60% of all electrical energy used. Energy efficient motors are the best solution to solve energy crisis .NEMA (National Electrical Manufactures Association) set standard for energy efficient motor and them named as premium efficiency motors.. The standard induction motors in a process plant consumes large amount of energy due to low efficiency. To save energy consumption in a process plant, the use of energy efficient motors are chosen over standard induction motor. Energy efficient motor have better efficiency and power factor than standard induction motors. The plant under study has 40 motors has different ratings. The work presented in this project examines the usages of extra energy in various standard induction motor in a process plant and encourage the use of energy efficient motors over standard induction motor. For this objective, a comparison of standard induction motor with energy efficient motor based on efficiency, (KW) motor input power, (KVA) apparent power, power factor, energy consumed(Kwh) according to running hours in a year and current. The payback period for energy efficient motors has also been calculated. In the end the study found that replacing standard motors with energy efficient motors is better than overall plant motor load also reduces. Also an India's power sector is facing an acute problem of meeting the growing demand of electricity. Improving energy efficiency by employing energy efficiency devices would be the better alternative for meeting part of the new demand. Instead of generally used standard motors, if energy efficient motor are used, it will result into sustainable saving in electrical energy. Energy efficient motor (EEM) gives more efficiency over a standard motor (STM). This can be achieved by making some changes in the design aspects, material used etc. principle of operation of EEM is same as a three phase standard induction motor. The electric motors consume a significant amount of electricity in the industrial and in the Service sector. In Power Sector facing a huge amount of energy demand, by improving energy efficiency by employing energy efficient device such as Energy Efficient Motor (EEM). The electric motor manufacturers are seeking methods for improving motor efficiency, which resulted in a new generation of electric motors that are known as energy efficient motors (EEM). Because of its simplicity and robustness, the three-phase squirrelcage induction motor such as standard motor may be replaced by Efficient Motor(EEM) give more efficiency and better Performance. This project involves energy conservation by installing energy efficient motor (EEM) instead of standard efficiency motor. Therefore, there are different practical cases in EEM is compared with standard motors rang 11HP and more rating of the motor it is very interesting the implementation of EEM in the industry refers to sugar factory Kopargaon, and case study has been discussed.*

Keywords: Standard Induction Motor, Energy Efficient Motor, Efficiency, Kilowatt, Power Factor, Energy

I. INTRODUCTION

In today's power scenario we are facing a major power crunch. Day by day gap between demand and supply of electric energy is widening at the rate of 3%. Bridging this gap from supply side is a very difficult and expensive proportion. The only viable way in handling these crises, in addition to capacity addition, is the efficient use of available energy, which is possible by using energy efficient devices. Electric motors are basic industry's need. Industries consume about 50% of the power generated in the country and electric motors consume around 70% of the total electricity used in the industrial sector. Majority of the motive loads use squirrel cage induction motor as the driving element. Most of the motors used in industry are oversized. Even when proper sized motor are used, they are not fully loaded to their capacities. This results into poor efficiency and power factor. However, the demand for energy cannot be overemphasized. Industries are known as heavy consumption of energy. Hence, the need to improve and sustain energy efficiency in the industrial sector has been a major concern in our modern society. Energy efficiency is the most important factor to consider when thinking about electric motors, as it is what drives the industrial sector. implementing high efficiency motors, such as energy efficient motors in the industries would reduce cost and conserve the environment by optimizing the efficiency of the entire system. Energy efficient motor integrates low-loss materials to reduce losses, such a score losses and copper losses. The use of energy efficient motors has been described as one way of mitigating global warming and optimizing energy consumption. Improved performance of energy efficient motor is attributed to better design, manufacturing and material techniques which are seen in high magnetic properties, reduced rotor and stator gap, high laminated stator winding, reduced heating and fan losses as well as better insulation. Energy efficient three phase induction motor has main two parts the stator are the stationary part and rotors have rotating parts. Stator is made by staking thin slotted highly permeable steel lamination inside a steel cast or cast iron frame. Winding passed through slots of stator when a three phase ac current passed through it produced rotating magnetic field. Compare to conventional system the efficiency of energy efficient motors available in the market offers 70-95% efficiency depending on the size. The higher efficiency of motor is achieved by reduced copper loss by using more copper conductor in stator and by using large rotor conductor bar. Reduced iron loss by using thinner cage low loss core steel and material with minimum flux density. Reduced friction loss by using improved lubricating system and high quality bearings. Reduced windage loss by using energy efficient fan and reduced stray loss by use of optimum slot geometry and minimum overhang of stator conductor.

II. LITERATURE SURVEY

In India the growing cost of energy due to limited stock of energy sources calls for power saving at each possible step in an industry. The three phase induction motors consumes about 70% of the electricity used in an industry. In earlier period, the induction motor design was based more with the initial cost of the motor rather than the energy it consumes. The materials such as aluminum or copper wires and steel laminations, were selected at the minimum level required to meet the performance requirements of the motor. Hence the induction motor have low power factors, more losses and low efficiency. Therefore the manufactures look forward for different methods to increase the efficiency of motors. To achieve these manufactures starts use of good and thin steel lamination materials having low losses and more amounts of copper wires in winding to increase the efficiency of induction motor.

The motors having high efficiency, good power factor and fewer losses are called energy efficient motor. Energy efficient motors have efficiency 2-3% more than standard motor. The changes in slot shape increases the efficiency and thus reduce the internal motor losses [1]. The use of energy efficient motors offers the utilities the possibility of achieving sustainable energy and demand reduction [2]. The energy efficient motors save demand and energy and result in acceptable payback period. [3]. Comparison of standard motor with energy efficient motor has been done on the basis of parameters like %efficiency, voltage, current, power factor, payback period of motors is also calculated.

About 65% of the total energy supplied to the industry is consumed by electric motor, which is a prime mover of the industry. Standard electric motor is known for low efficiency due to compromise made on the materials during manufacturing. This has also resulted in the high maintenance and running costs, high energy losses and greenhouse emission. Improved performance of energy efficient motor is attributed to better design, manufacturing and material techniques which are seen in high magnetic properties, reduced rotor and stator gap, high laminated stator winding, reduced heating and fan losses as well as better insulation. Energy efficient motors should be considered in the following instances:

- For new facilities or when modifications are made to existing installations or processes.
- Instead of rewinding failed standard efficiency motors.
- To replace oversized aid under loaded motors.

- As part of an energy management or preventative maintenance program.
- When utility rebates are offered that make high efficiency motor retrofits even more cost effective.

III. PROBLEM STATEMENT

In the future, the cost of energy will increase due to environmental problems and limited resources. The electric motors consume a major part of the electric energy in industries. Thus, implementing energy efficient motor could save a significant amount of electricity. It would also reduce the production of greenhouse gases and push down the environmental cost of electricity generation. Also these motor can reduce the maintenance costs and improve operation in industry. As a global energy demand continuous to grow, actions to increase energy efficiency will be essential. The technical opportunities are myriad and potential savings real, but consumers and utilities have so far been slow to invest in the most cost-effective, energy- efficient technologies available. The energy efficiency of industries, electric equipment, and appliances in use falls far short of what is technically attainable. Electric utility energy efficiency techniques have great potential to narrow this gap and achieve significant energy savings. India has a great dependence on energy so it is an important goal the promotion on energy efficient motor is be applied in the industry.

IV. OBJECTIVE AND SCOPE

In the present day world, energy conservation or optimization by a small means plays a significant role in making huge profits for any industry. This project explains the need of improving energy efficiency and particularly in motors. In industries, motor driven systems represent about 60% of all the electrical energy used. Energy efficient motors are the best solution to solve energy crisis. NEMA (National Electrical Manufactures Association) set standards for energy efficient motor and named them as premium efficiency motors. As global energy demand continues to grow, actions to increase energy efficiency will be essential. The technical opportunities are myriad and potential savings real, but consumers and utilities have so far been slow to invest in the most cost-effective, energy-efficient technologies available. The energy efficiency of buildings, electric equipment, and appliances in use falls far short of what is technically attainable. Electric utility energy efficiency techniques have great potential to narrow this gap and achieve significant energy savings. Some of the recent trends in energy efficiency technologies that have been successful and also used widely worldwide are: 1) Energy efficient motors 2) Soft starters with energy saver 3) Variable speed drives 4) Energy efficient transformers 5) Electronic ballast 6) Occupancy sensors & Energy efficient lighting controls 7) Energy efficient Lamps. The main purpose of the study is determination of energy efficiency potential in 3-phase electric motors of the industry. Major factors influence the efficiency of a motor are: motor efficiency, motor speed control, proper sizing and power supply quality. Minimization of losses is the main purpose of high efficiency electric motors. This duty is done through. Reducing the losses in the windings. This is done by increasing the cross-sectional areas of the conductor or by improving the winding technique to reduce the length. • Using better magnetic steel • Improving manufacturing tolerances • Improving the aerodynamics of the motor The production cost of a high efficiency motor maybe up to 30% higher than a similar standard one, but reduction of losses and therefore electricity consumption will lead to short payback period of this investment. Various researches during recent decades, have led to 1-10% increase in energy efficiency of these equipment's. It is noticeable that this substitution is more effective in low capacity electric motors.

V. ADVANTAGES

- Energy efficient motors offer other benefits because they are constructed with improved manufacturing technique and superior materials, energy efficient motors usually have higher service factors longer insulation and bearing lives lower waste heat output and less vibration all of which increase reliability.
- As the platform rides above the track on a cushion of air, there is no loss of energy to friction or vibration.
- As both acceleration and braking are achieved through electromagnetism, linear motors are much quieter than ordinary motors.
- The EEM has a greater efficiency than a standard motor, therefore they have less operating costs.
- EEM has lower slip so they have a higher speed than standard motor.

- EEM can reduce maintenance cost and improve operation in industry due to robustness and reliability.
- Increasing the productivity.
- Higher quality and thinner lamination in the stator.
- More copper in the winding.
- Optimized air gap between rotor and the stator.
- Reduced fan losses.

VI. APPLICATIONS

- Energy efficient motors are especially suited for industrial which are power intensives which are power intensive and equipment's which run on constant load for long duration.
- For example: Fan, blowers, pumps, compressors etc., are some of the driven equipment's and industries such as textile, paper, cement, power generation etc.
- Motors are suitable for wide industrial applications like paper cement, textiles, cranes, material handling, machine tools and blowers etc.

VII. CONCLUSION

Conclusion a detailed analysis of the energy efficiency of the industrial motors has been presented in this project. One part of the fixed losses may be reduced by using advances materials with smaller area of hysteresis loop and another part by using better stacking of the core and high resistivity material. Friction and windage losses may be reduced using better aerodynamic design of rotor and bearing with low friction. The optimum design gives a motor having uniformly high efficiency over a wide range of load and supply voltage. It is seen that, within the same frame size, the full load efficiency of the new motor is about 2.5% more than that of the standard motor and the input kVA is 3% less than that of standard motor. The active material cost of the energy efficient motor is up to 15% more than that of the standard motor, but the extra cost is paid back within a reasonable period, which is calculated to be even less than a year for the prevailing cost structure. In addition, the high efficiency motors operated closer to the peak efficiency over a wide range of loads than did the standard motors, so that the difference in the efficiency was even greater at less than full load, where many motors operate much of time. Thus by improving the efficiency of the induction motor we can also contribute in making the environment clean for all living-beings and today when global warming i.e. pollution is increasing day by day.

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