ABSTRACT

Keywords: Energy Audit, Instruments-used, Economic Analysis, Recommendations, Innovative Heat Pump, Energy conservation, Implementation of recommendation

Industries in India are being encouraged to use renewable energy and reduce their carbon foot print through the PAT scheme (Perform, achieve and transfer) introduced and monitored by the Bureau of Energy Efficiency.

As a first step, IP Rings a leading manufacturer of auto components in India, used an energy assessment conducted by IIT, Madras, to identify energy losses in major utilities like cooling towers, motors, pumps and transformers to answer the question… **How can air, water and heat consumed in the form of electricity consumption identified through energy assessment audits be reduced.**

The methodology used follows the cycle shown below. As a first step, data is collected to establish base-line figures on consumption. Subsequently, specific instruments are used to measure certain key parameters. These parameters are then used to perform calculations to understand the efficiency at which these utilities are working and identify areas of improvement. The recommendations would involve investments as well in some cases, which the management of the company evaluates to justify the returns.

The recommendations made would enable the company to save atleast **10** % of air, **5** % of water and **5** % of electricity consumption. In financial terms, the company will be able to save Rs 54.35 Lakhs (USD 69,679) by making an investment of Rs 22.9 Lakhs (USD 29,358). The Return on investment is calculated to be ROI = Investments / Savings and is worked to be 5.04 months which is as per the norms and IPR has made a decision to make this investment.

Chapter 1: Introduction

The phenomenon of rising temperatures puts global ecosystems at risk, the world is at a pivotal moment to mitigate the long-term effects of this phenomenon and prevent irreversible climate change (IPCC). A net-zero approach by all nations to utilizing and harnessing energy is vital [IEA (2021)]. The Intergovernmental Panel on Climate Change (IPCC) estimated that the likelihood of limiting global warming to 1.5 degrees Celsius will improve to a significant extent if the world achieves net-zero emissions by 2040 (IPCC, 2019). This has led to a recent push by economies to adopt green policies in a larger effort to rethink sustainability and address climate change.

India's updated commitments under the Paris agreement or NDC's (nationally determined contribution), aims to reduce emissions intensity by 33 – 35% from its 2005 levels. India has also pledged to set up 450GW of renewable energy and increase the share of non-fossil fuel sources in its energy generation capacity to 57 – 60% by 2030. Besides these actions, the Government has set up sub-goals to help guide critical sectors such as industry, electricity and transport. Specifically, the PAT (perform, achieve and transfer) launched by the Bureau of Energy Efficiency (BEE) is a market based compliance mechanism. It aims to encourage industries to improve their energy efficiency. As an added incentive, industries can convert their energy savings (ESCerts) into tradable instruments which can be bought and sold in power exchanges.

Buoyed by the success of previous PAT cycle targets between 2012 and 2021, the BEE aims to include more sectors in PAT cycles 5 and beyond. In anticipation and preparation for this IP Rings has embarked on a series of initiatives to become carbon neutral in 10 years' time.

While the company has used energy assessments as a tool in the past, the improvements have been incremental. IIT with its sophisticated methodology and innovative ways of interpreting data were chosen to lead this initiative through their Centre of Excellence – The Kotak IIT Save Energy Mission (KISEM).

1.1 Objective:

Main objective of this study is to take some constructive actions towards climate change and energy crisis. So, after lot of brainstorming, literature review and expert consultation we came to the main objective of the study.

"What is energy saving potential of a manufacturing industry and identifying these potentials with the help of energy audit"

1.2 Scope of the project

For completing this study we choose IP Rings, Chennai as the base manufacturing industry to conduct energy audit. We studied major utilities such as motors, pumps, cooling towers, lighting load, harmonics, compressor and historical data of EB bill and power factor.

Chapter 2: MY CONTRIBUTION

2.1 During my internship at IP Rings Ltd, a leading manufacturer of auto components in India, I noticed that they were planning to embark on an Energy assessment audit to help them create a carbon neutral facility over the next decade. Having heard about the impact that climate change was having on the world I was interested in understanding how manufacturing units could contribute to this phenomenon and I requested the company if I could be a part of the team tasked with the survey.
Besides the 3 IIT professionals , IP Rings also allotted a team of 5 people as part of this exercise. I was part of this team but was guided by my mentor Mr Piyush Tamrakar M.Sc IIT who was leading this initiative.

2.2 My Role:

1) I was first tasked with reading and understanding the document and guidelines published by the Bureau of Energy Efficiency. The highlights that were applicable to an Industry like IP Rings was the perform, Achieve and Transfer scheme (PAT Scheme). I highlighted the benefits of energy savings and tradable ESCerts in the introduction section of this document.
2) I also learnt about Energy audits and wrote the section on Energy Audits.
3) My specific role as part of the team was to take physical measurements using
    - a clamp meter to measure electrical current, voltage, active power, reactive power, apparent power and power factor.
    - a water flow meter to measure water flow rate and velocity of water.
    - A power quality analyzer to measure power supply anomalies
    - Ultrasound air leak detectors to measure leakage of air
4) I summarized the data into tables and observed the team brainstorm and arrive at solutions.
5) The innovative solution that IIT brought was to use Heat pumps to replace heaters. This also gave the company the maximum savings. I was also exposed to the principle behind the workings of a heat pump.
6) On analyzing the recommendations, I found that Maximum savings came from heaters and chillers, followed by wasted air and lastly by motors and pumps.

2.3. Problems faced:

1. At first I didn't understand what measurements and the purpose behind the readings. It was only during subsequent interactions that I realised the importance of the parameters I was measuring
2. I also found it difficult to understand why energy measurements were being carried out on a few utility equipment like transformers , compressors and motors while there were literally hundreds of other equipments that were being used. On sitting with the team I realised that this was a Phase 1 of the project and focussed on equipment that would not affect the quality of parts being produced.

2.4 Future Actions and Recommendations

1. Given the climate concerns facing the plant, I believe that Industries can play a significant role in reducing energy consumption and move towards a Carbon neutral world.
2. As a first step , IP Rings are committed to extending the audit to cover other areas.
3. I believe that the state of TamilNadu with its huge Industrial base will soon mandate stricter norms for energy consumption.