

A Walkthrough Energy Audit of Royal Cool Solutions Ltd

HARISH SUDHAKARAN NAIR

M130093EE

Table of Contents

Executive Summary	1
Introduction and Objective.....	2
Methodology	3
General information about the industry.....	4
Electrical Equipments in the Industry.....	6
Energy Conservation Measures.....	8
Conclusion.....	10

Executive Summary

A walkthrough Energy Audit was conducted in Real Cool Solutions Ltd, to identify the electrical energy consumption pattern, electrical energy utilizing equipments used and to identify scope of energy saving opportunities, if any.

The walkthrough audit of the industry basically involved a visual inspection of various electrical equipments and installations, recording their ratings, duration of operation etc. and thus identifying existence of any possible energy saving opportunity.

Certain energy saving measures were identified with regard to lighting, proper thermal insulation of office room, replacement of fan regulators, optimal use of lights etc. These measures were informed to the plant personnel for necessary corrective action.

Introduction and Objective

A walkthrough energy audit was conducted in Royal Cool Solutions Ltd on 12 October 2013. An energy audit is a study of a plant or facility to determine how and where energy is used and to identify methods for energy savings. There is now a universal recognition of the fact that new technologies and much greater use of some that already exist provide the most hopeful prospects for the future. The opportunities lie in the greater efforts at energy efficiency and the use of these technologies and options. Therefore, an energy audit is a preliminary activity towards instituting energy efficiency programs in an establishment. It consists of activities that seek to identify conservation opportunities preliminary to the development of an energy savings program. Identifying where energy is used is useful because it identifies which areas the audit should focus on and raises awareness of energy use and cost. The results of the analysis can be used in the review of management structures and procedures for controlling energy use.

Important Points to Consider When Collecting Site Load Data

- a. Operating hours - This can be gathered from plant personnel. It is important to ensure the accuracy of this data because much of the potential for energy savings lies on correct estimation of the equipment's operating hours.
- b. Duty cycle - Machines such as large electric motors have varying loads and hence, different power requirements.
- c. Actual power consumed - For electric power users, this is based on either 3-phase current/voltage readings or power analyzer measurements. However, since this is a walkthrough energy audit, exact power consumption is not measured.

The objective of conducting this audit is to identify the electrical energy utilizing equipments, their ratings, period of use and energy saving potential that exist in this particular industry.

Methodology

The Energy audit was carried out based on walkthrough type Energy audit, as well as giving special focus on identifying several areas that have the potential to implement energy savings measures. The following is a list of general procedure followed during the walkthrough energy audit during the industry site visit:

1. General information gathered regarding the industry.
2. Identify the electrical equipments utilized for various processes/activities and their ratings.
3. Approximate usage of each equipment per day.
4. Recommendation of energy conservation measures.

General information regarding the industry, its operation and product portfolio was enquired with the employees present in the industry at the time of this energy audit. This included the work pattern followed by the industry as well as other details such as number of employees and number of working hours, shifts etc.

The rating, operation pattern, operation duration of each electrical equipment was recorded and actual operation and condition of equipment was analyzed by simple visual inspection.

Wherever possible, the energy saving measures were identified, however keeping in mind that accurate measurements are not possible in a walkthrough audit.

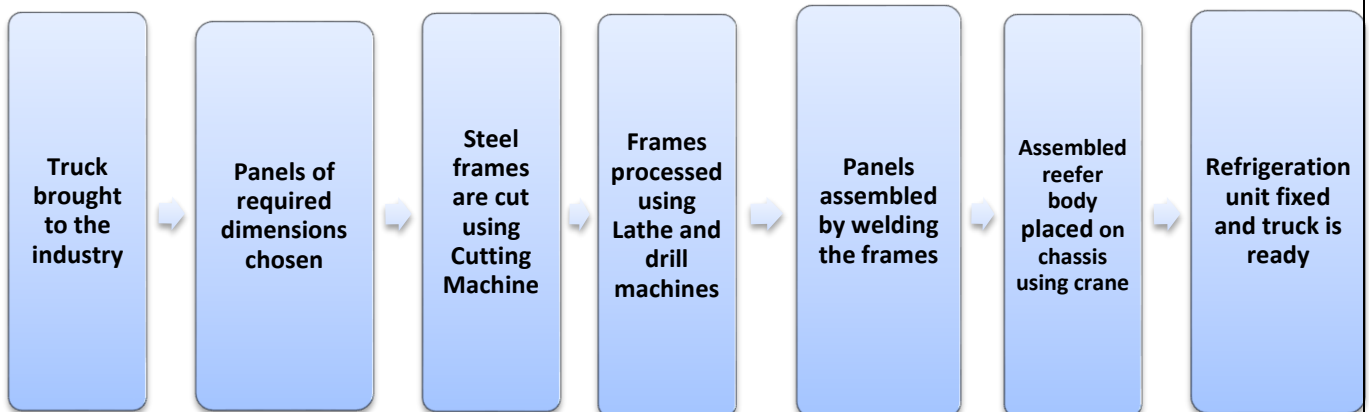
Based on the observations, energy saving opportunities were analyzed and a simple savings calculation was carried out for justification.

General Information about the Industry

Royal Cool Solutions Ltd is an industrial unit in Tirunelveli in Tamil Nadu that is involved in assembling the sandwich panels used in truck refrigeration reefer body. This industry works for 8 hours a day in a single shift for six days in a week. The industry has approximately 20 employees.

This industry assembles the panels that make the reefer body (i.e. the container fixed on to the chassis of the truck) which is mounted on the truck chassis. These reefer bodies are equipped with truck refrigeration units such those by Thermoking or Carrier. Installation of the refrigeration units onto the reefer body is also done by this industry.

The basic activities involved in this industry can highlighted using the block diagram as shown below:



The block diagram can be explained as follows:

- The Truck to which the reefer body is to be fixed is brought by the customer to the industry. The panels suitable for that truck model are chosen by the industry.
- Steel or Aluminium frames that are used for assembling the panels are cut to required dimensions using the metal cutting machine.
- The cut frames are further made into required specifications using lathe and drilling machines.
- The panels are assembled with the help of the above said frames by welding and other methods to make the reefer body.
- The assembled reefer body is lifted using a crane and placed on to the chassis of the truck and fixed to the truck.
- The refrigeration unit is then installed in this truck.
- The truck is cleaned and ready for delivery.

ELECTRICAL SPECIFICATIONS:

LT industry

Tariff type as per TNEB: LT III B

Tariff rate Rs. 30/kW/month and Rs. 5.50/kWh

Connected load = 40 kW

Electrical Equipments in the Industry

The following electrical energy consuming equipments were found to be in use in the industry-

1) Lighting

i) Industrial Lighting:

Eight industrial type lights each of 250W, 230V operated for 8 hours per day.

ii) Office lighting:

Four fluorescent bulbs each of 60W, 230V operated for 8 hours per day.

iii) Other lighting:

Five incandescent bulbs each of 100W, 230V operated for 12 hours per day.

2) Fans:

i) Exhaust fans :

Four Industrial type exhaust fan each of 100W, 230V operated for 8 hours a day.

ii) Office Ceiling fan:

Three ceiling fans 65W, 230V operated for 9 hours per day.

3) Office Air conditioner:

One LG 1 ton AC 1kW, 230V operated for 8 hours per day.

4) Office computer:

Two desktop office computers operated for 8 hours a day.

5) Water pump:

Single phase, 230V, 1.5 HP motor, Class F, Grundfos make.

6) Drill Machine:

Three phase, 415V, 50Hz, Drill motor 1HP and arm motor 0.5 HP operated for 4 hours per day.

7) Cutting machine :

Three phase, 415V, 11kVA, 50Hz, 0.93pf operated for 4 hours per day.

8) Welding machine:

Single phase, 3kVA, 230V, 0.93pf operated for 4 hours per day.

9) Lathe (light duty machine):

Three phase, 1 HP, 440V, 50Hz, 1440 rpm operated for 3 hours per day.

10) Overhead crane

One overhead travelling crane 2 ton, 16.6kW, 415V, 3 phase operated for 3 hours per day.

11) Water Wash machine:

2 HP motor, 1400rpm, pump 300rpm, 230V operated for two hours each day.

Equipment	Number	Ratings	Hours of use
Industrial Lighting	8	250W, 230V	8
Fluorescent bulbs	4	60W, 230V	9
Incandescent bulbs	5	100W, 230V	12
Industrial type exhaust fan	4	100W, 230V	8
Ceiling fans	3	65W, 230V	9
Desktop office computer	2	250W	8
Water pump	1	Single phase, 230V, 1.5 HP motor, Class F, Grundfos make.	6
Drill Machine	1	Three phase, 415V, 50Hz, Drill motor 1HP and arm motor 0.5 HP	4
Cutting machine	1	Three phase, 415V, 11kVA, 50Hz, 0.93pf	4
Welding machine	1	Single phase, 3kVA, 230V, 0.93pf	4
Lathe (light duty machine)	1	Three phase, 1 HP, 440 V, 50Hz, 1440 rpm	3
Overhead travelling crane	1	2 ton, 16.6kW, 415V, 3 phase	2
Pump for vehicle wash	1	2 HP motor, 1400rpm, pump 300rpm, 230V	2

Energy Conservation Measures

The following are some of the energy conservation measures that were identified during the walk through audit of this industry.

Lighting:

There were approximately five nos. of 100W incandescent lamps used. These can be replaced by CFL bulbs for energy saving.

Cost Analysis of Replacing incandescent lamps with CFLs (23W):

Total No. of incandescent bulbs =5

Average Power saved per bulb = 77W

- Total Power saving = $5 \times 77W = 385W$
- Average Use of bulbs per year = $320 \times 12h = 3840h$
- Total Energy saved per year = $3840 \times 0.385 \text{ kWh} = 1500\text{kWh}$
- Saving in Rs. Per year = $\text{Rs. } 1500 \times 5.5 = \text{Rs } 8250$
- Average Cost of Replacing bulb = $\text{Rs. } 250$
- Total Cost of Replacing all bulbs = $5 \times 250 = \text{Rs. } 1250$
- Capital Cost Recovery time = $(1250)/(8250) = 0.2\text{yr}$

Hence, the capital cost recovery time for replacing all bulbs of the office is around 0.2yr.

Insulation of windows:

Since air conditioner is being used in the office building, proper insulation is required, however, windows were not properly closed and doors were kept open longer than usual. ACs were found to be used without keeping curtains. These poor practices account for increase in AC load and thus consumption.

Summarized below are some guidelines for most efficient use of ACs:

- **Proper Insulation** – Good quality insulation must be maintained in the air conditioned rooms by keeping all doors and windows closed properly so as to prevent cool air go outland hot air come in.
- **Curtains** – Always keep curtains on windows to prevent direct sunlight inside the room to avoid heating of cooled air. This reduces AC load significantly.
- **Maintenance** – Proper maintenance and cleaning of ACs is required at regular intervals to make it work at highest efficiency. Any dirt in filter may reduce efficiency of ACs very significantly.

- **Operating** – The ACs should be switched on 15 minutes before actual use and should be switched off before leaving the room.

Fan regulators:

The industry continued to use an old office building which had old fan with conventional regulators.

It is therefore suggested to replace them with electronic regulators for better energy saving and longer life.

Cost Analysis of Replacing Resistance regulators with Electronic regulators:

Total No. of resistance regulated fans in office= 3

Average Power saved per fan = 8W

- Total Power saving = $3 \times 8W = 24W$
- Average Use of fans per year = $313 \times 9h = 2817h$
- Total Energy saved per year = $2817 \times 0.024 \text{ kWh} = 67\text{kWh}$
- Saving in Rs. Per year = $Rs. 67 \times 5.5 = Rs. 370$
- Average Cost of Replacing regulator per fan = Rs. 150
- Total Cost of Replacing all resistance regulated fans = $3 \times 150 = Rs.450$
- Capital Cost Recovery time = $(450)/(370) = 1.2\text{yr}$

Hence, the capital cost recovery time for replacing all resistance regulated fans of the office is around 1.2 years.

Optimum usage of compound wall lights:

Few lights near the gate were found to be turned ON even during the day indicating negligence to turn them OFF in the morning. Plant employees must be made aware about the importance of electrical energy and advised to turn off unwanted lights etc.

Conclusion:

A walkthrough Energy Audit of Royal Cool Solutions Ltd has been conducted and analysis were made based on the observations. Since the industry is relatively new and follows good energy practices, no significant energy wastage was found. However, certain minor energy conservation measures were identified and the particular suggestions and their feasibility have been informed to the concerned person in the industry.