

An Action Plan for Reducing Power Wastage in Technical University

Abhishek Arya, Jyoti, Shailesh, Nity , Mustupha, Pratap,
Shubham, Vineet and Bhuvanewari
Member - MGR Vision 10MW, EEE Departement
Dr.M.G.R Educational and Research Institute
Chennai, India

mgrvision10mw@drmgrdu.ac.in
abhishekarya1309@gmail.com

Ramesh.L¹ and Sheeba Percis²

¹Director- MGR Vision 10MW and SUPERCEN
^{1,2}Professor, Dr.M.G.R Educational and Research Institute
proframesh@green9.org

Abstract- The laziness and indiscipline activities of the human being will result to the wastage of major products. In these power wastages plays a vital role in Asian countries where power wastage can be saved. This project presents the study in the technical universities about the power wastage. The team suggested five types of recommendation to avoid power wastages strongly. The net results indicate zero wastage in the proposed universities.

Keywords— Energy Audit, Wastage, Power

I. INTRODUCTION

With energy prices on the rise and antique power grids patched together with gum and twine, it's time to take some control and get serious about reducing our wasteful use of energy. If we want to study and analyse the wastage then what is wastage? And what is the reason of its existence? And who are the ones which are responsible for it and also how can we cope with it? We should know the origin. When we talk about water wastage the first thing which comes to our minds is the running taps from which water is coming continuously and which have remained unattended for long time. The cause of food wastage or loss is numerous, and occurs at the stages of production, processing, retailing and consumption. As per a survey by IIM Kolkata, only 10% of food gets cool and dry storage facility in India. Another major wastage issue is the fuel. Due to the population, technological growth and people affordability, the number of vehicles got increased. Increase in the new vehicle again uses of fuel increase, so wastage of fuel increase. Traffic signals are one of the major spots, where we can literally see wastage of fuel in a large number.

Unlike wastage from water, food, oil, medical, etc. Power or energy wastage is one of the major growing concerns in today's scenario. Similarly electrical energy or power wastage is also one of the growing issues which we have to tackle in order to brighter the future of tomorrow. The world scenario of electrical demand in the society is increasing day by day and due to this the demand is not matched with the generation. One other way of wasting electricity without utilising it is as follows- **Plugging but not playing:** - Forget about the zombies it's much more likely that our home is filled with vampire. Energy vampires are those devices and applications which we tend to leave plugged in 24×7 whether we are using them or not. And – ON or OFF – energy item that's plugged in

is sucking power in a vampire style. Similarly cranking up the oven, getting in hot water or dish drawing are the some examples of energy wastage. Energy auditing and conservation can save India Rs1800Crore / year equivalent to installation of 5250 MW.

With the help of wastage audit, we can find the level of wastage and idea to minimize it. To support the wastage audit initiative, MGR Vision 10MW team members conducted the preliminary power wastage audit for one year period and detailed wastage audit for fourteen days with the time period of eight months. The necessary recommendations are suggested for reducing the wastage power.

II. WASTAGE AUDIT LITERATURE STUDY

The research team made an extensive study for the literature on the wastage audit problem under study. Literature was nice on the topic and awareness about the topic is very encouraging among the students as well as among the people those who are thinking that they are paying high amount of electricity bill.

Ann C. Wilkie et al., has conducted the wastage audit in Colombia at three Florida school in 2013. The overall audit has classified in three school namely A (under 5th class students), B (5th-9th), C (9th-12th). There are 436, 247 and 355 students respectively. In that school the overall wastage of food was 40-45%. In that the high percentage wastage of food are:-lunch-40%, milk, juice and other soft drink-30%, vegetable and fruits- 25% and paper, water, plastics product-5%. They are using two ways to sort-out this wastage, 1) Reduction through awareness and 2) Recycling process. The wastage comes due to the bad quality of food, for which they gave recommendation that the cafeteria food must be neatly prepared and hygienic. To stop this wastage they need to prepare the food in accordance with nutrition requirement/student/day. After this audit and recommendation they save approx. 70% of wastage. **Anil Kumar et al.,** from Madhav Institute Technology, has conducted the wastage audit at substation. The installed capacity of station (400/220kv) was very large compared to actual load it had supply to the consumers. Thus the station was under loaded and energy wastage was there. The problem was also creating due to the bad performance of equipment, power quality problems, operations and loading pattern at the substation. The

improvement suggested after performance analysis was bus reactor, maintaining the quality of power supply, making system harmonic from use capacitor bank for better power factor and efficiency. And also the bad performer equipments should be replaced instead of repairing. Automatic data logger should be installed hourly for the performance analysis. Through these measures they had reduced the wastage of power at the substation.

Madison et al., has done the biomedical wastage audit in the uttrakhand. The wastage audit was done to a certain quantity of bio-medical waste chosen from different categories health care facility, hospitals, clinics and nursing homes to form a basic for developing treatment and disposable system. The sample sites for the bio medical waste audit were selected on the basis of demographic and geographical considerations. Therefore, a minimum of two numbers of each type of healthcare facility, one from the plains and another from the hill region. In keeping with the above plan, quantification study was conducted in 10 facilities of the State for a period of 15 days. During quantification study, the following observations related to infection control and waste management were recorded; the general cleanliness in the healthcare facilities was not up to the desired level. There was no regular administrative monitoring. Mixing of general waste with infectious waste is a common feature. At times half filled bottle of Glucose is thrown, which increases the proportion of bio medical wastes. They gave recommendation for reducing wastage in medical field. The general cleanliness in the healthcare facilities has to be up to the desired level and There must regular administrative monitoring. And also general awareness program should be conducted in order to how to use the medicals things and how to keep the hospital neat and clean the hospital in order to save from many diseases. **Tiwari et al.**, has conducted the wastage audit of fuel usage. observation conducted for 12 hours (8:00AM to 10PM) at 45 different traffic signals of Indore city and made a survey for a week (Monday to Saturday) to estimate the extra fuel consumption due to idling of the vehicles while waiting for green signals. It is come out of study that around 1000L petrol, 660L diesel and 480kg CNG per day is being wastage due to idling of vehicles in Indore. These things are happening because of lack of awareness of peoples towards traffics and their personal mentality. This is because people often leave the engine of their vehicle running while waiting at signals. Apart fuel wastage is not there, it also causes pollution of environment, badly effect on the vehicles engine and human health. They gave recommendation that, public awareness programs should be conducted to raise social consciousness. An effective traffic control needed between 8am to 10am & 4 pm to 6pm because many numbers of idle vehicles taken into account at that period. For estimation of loss of fuel, following self-generated formula have been used i.e. amount of fuel wastage = (no. of idle vehicle) × (time to red signal) × (idle fuel consumption factor in ml/sec). It can't be totally control but fuel consumption and pollution may slightly control by changing the behaviour of driver/rider. Today there are 900 million hungry people worldwide and one billion people overfed. Under the current production and consumption trends, global food production will need to increase by 60% by 2050. Lost and wasted food represents a missed opportunity to

feed the growing world population. The global economic cost of food has wastage, based on 2009 producer prices, is 750\$ billion, approximately the 2011 GDP of turkey or Switzerland. The different foods are wasting daily is cereals, roots tuber soil, seeds, pulses, fruits, vegetables, meat, fish, seafood and dairy products. In that roots tube soil, fruit, vegetables wastage is maximum. The production is 100%, where consumption of these foods is only 48%. These are happening because of lack of awareness, mentally of people and also due to some natural effect like: - soil condition, unavailability of water, climate, and biodiversity. Toward this they give recommendation that: - invest in better storage technology. Allow consumers to customise the amount of food they buy. Donate unsellable and edible food. Don't buy more than what is necessary, by planning meals, creating a detailed shopping list and shopping more frequently, buying less each time. Store food properly, whether in air tight containers or in refrigerator. Through this we can save one-third part of overall food which is going wasted.

SFWS has conducted the wastage audit of water. This Action Plan has been developed to assist the construction industry in reducing the wastage of water on construction sites. The major challenge that the industry currently faces is a lack of understanding of where water is used on construction sites. The Action Plan is a contribution to delivering a water target within the joint government and industry Strategy for Sustainable Construction launched in July 2008. This Plan addresses the target of "By 2012, water usage in the manufacturing and construction phase to be reduced by 20% compare to 2008 usage" An agreed methodology for measuring water usage. Identify water use on construction site by process/activity. Improve site water use behaviour, processes and technologies. They gave recommendation towards the wasting of water; Conduct a walk-through survey of the site. Collect data on water use from the monitoring system. They should also aware about:- a) value of money. b) The work environment. c) Habit and mentality. d) Eliminate water wastage on site. e) Improve efficiency of water using processes. f) Water saving equipment and practises. Based on this data, the introduction of this technology and awareness alone could save over 20% of water used. **Aurora et al.**, Conducted the wastage audit of milk at a particular dairy. As population increasing day by day quality milk replacers are expensive. To reduce that cost, dairies may opt to feed waste milk. There is adequate waste milk to feed 6 quarts per calf daily. One farm milk pasteurize can allow producers to use waste milk, while reducing pathogen concerns and cutting milk replacers costs. They are using two ways to pasteurize the waste milk. 1) Batch pasteurizers are less expensive than HTST ones. 2) only the amount of milk that will fit into the pasteurization tank can be processed in batch pasteurizers. Better Milk has units that pasteurize 45 to 90 gallons per hour (GPH), with 20- to 150-gallon pre-pasteurization holding tanks. As batch size increases in a batch pasteurizer, it's important to verify that milk is being properly agitated and heated to the desired temperature for the desired time. More than 58% of immunoglobulins were denatured when large batches (25 gallons) of colostrums were pasteurized, while the loss was reduced to 25 to 30% with a smaller batch (15 gallons). The researchers suggest that the greater loss of

antibodies in the larger batch was probably the result of needing 2.5 to 3 hours to heat the volume of colostrums. This milk is stored in an unrefrigerated storage container until being fed that night. Bacteria don't grow at temperatures above 140 degrees F. Pasteurizing waste milk makes sense for larger dairies. Always take care to minimize the contamination of milk with manure and pathogens.

Raj Kumar Yadav et al., has conducted the wastage of heat at industries. The project involved laboratory coal drying studies to gather data and develop models on the factors which control the rates of drying. The costs of coal drying will depend heavily on site specific factors. Wastage created by a typical 500 megawatt coal plant includes more than 125,000 tons of ash and 193,000 tons of sludge from the smokestack scrubber each year. Toxic substances in the wastage including arsenic, mercury, chromium, and cadmium can contaminate drinking water supplies and damage vital human organs and the nervous system. A typical coal power plant uses only 33-35% of the coal's heat to produce electricity. Now a day's many industries and research institute using these technologies fly ash is one of the major by products of thermal power plants these fly ash is having a tremendous high temperature at the time of exhausts from the chimney and these fly ash after cooling is used in making doors ,windows and also these things are fire proof if these fly ash do not use in these things they need a lot of area for decompose The results have been shared in various workshops including a national workshop for the construction materials industry which was attended by numerous brick-making factories. And also the extra heat has recycled ie;- condensed and again supplied to the boiler from where it transmit to the turbine. Through this we can't save fully but somewhat heat we can utilise.

In the above the possibility of savings in the food, fuel etc were studied with the help of wastage audit in the particular field. It was found that power wastage audit did not execute for the Technical University. Keeping in this mind the MGR Vision 10 MW team members conducted the power wastage audit in the technical University, Tamil Nadu. The strong recommendation were suggested for effective power saving.

III. POWER WASTAGE AUDIT

Wastage audit has been conducted in an engineering university. Past two years several preliminary wastage audits conducted and two major audits taken as sample. These audits are conducted in summer time. It has been completed in two stages. The audit is conducted in two consecutive years 2015 and 2016. Two teams have participated in that wastage audit. **Team-I** has conducted the wastage audit in the university in 2015, whereas the **Team-II** have done in the same university in 2016.

The wastage audit conducted, the real time data which consist of usage of several appliance like light, fan, AC and PC. The particular audit is conducted in 5 blocks which is named as **block-A**, **block B**, **block C**, **block D** and **block E**. The graph is plotted based on the real time data, which is shown below.

Wastage audit study in 2015: The team members conducted the power wastage audit in the entire block with the

reference to the proposed audit procedure. The collected data recorded with the available template. Continuous three week monitoring is recorded and presented the average value for six days from Monday to Saturday.

Table- (a): -Per day power wastage block-wise

BLOCKS	DAY-1	DAY-2	DAY-3	DAY-4	DAY-5	DAY-6	DAY-7
Block A	98	105	117	124	109	95	85
Block B	36	26.72	27.3	16.58	26.84	17.28	15.38
Block C	149.43	108.392	166.43	137.215	106.92	98.567	95.234
Block D	9.864	5.679	10.732	5.234	3.251	3.675	2.376
Block E	23.44	12.372	19.196	18.235	20.23	15.11	11.321

The **Table-(a)** represents the energy wastage for six days. Through this it is graph observe that the **block -C** is having the maximum power wastage as approximately take data from table (unit). Whereas the **block- A** is having the average wastage.

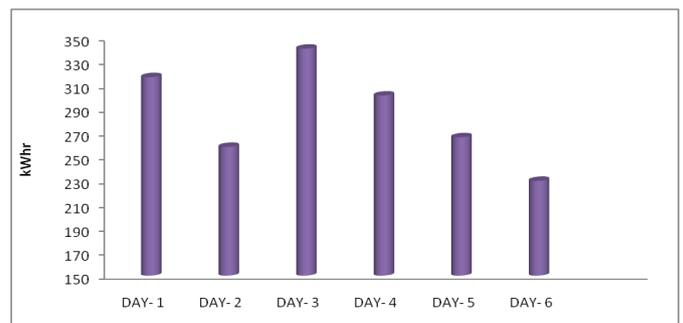


Fig-(1) Per day overall wastage graph

The **figure-(1)** represents the total energy wastage for six days. From this calculated the actual power consumption per day. The data of day-3 wastage is maximum, due lights which amount to Rs. 2060 towards energy charges. Day -1 and 4 is having the average wastage as 310Kwhr (unit) and 311Kwhr (unit). Here the energy costs will Rs. 1969. Due to holiday day-6 having the minimum consumption and least cost.

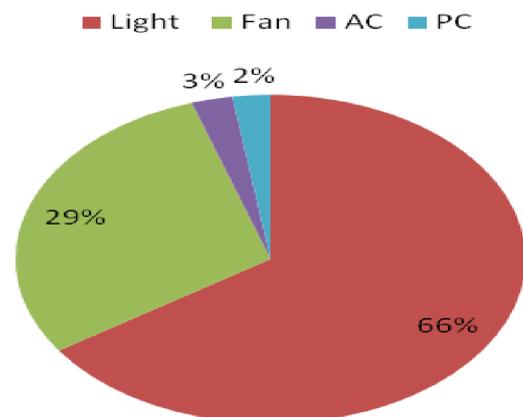


Fig- (2) Appliances percentage

The pie chart represented in **fig- (2)** shows appliances will distribution of wastage. The light is contributing 66%

towards wastages, Fan 29%, whereas PC and AC 3% and 2% wastages respectively.

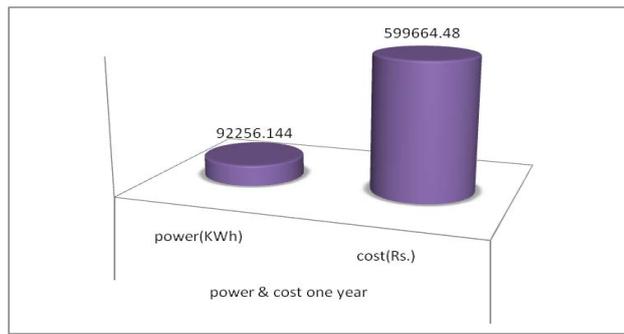


Fig. 3: Power (kWh) & Cost per annum

The **figure-(3)** is showing the value of power wastage per year and its cost. The overall expense university is paying on wastage is 5lakhs 85 thousand per year. The weekly and the monthly expenses is 12493.01 and 49972.04 respectively.

Wastage audit study in 2016: The team members conducted the power wastage audit in the entire block with the reference to the proposed audit procedure. The collected data recorded with the available template. Continuous five week monitoring is recorded and presented the average value for six days from Monday to Saturday.

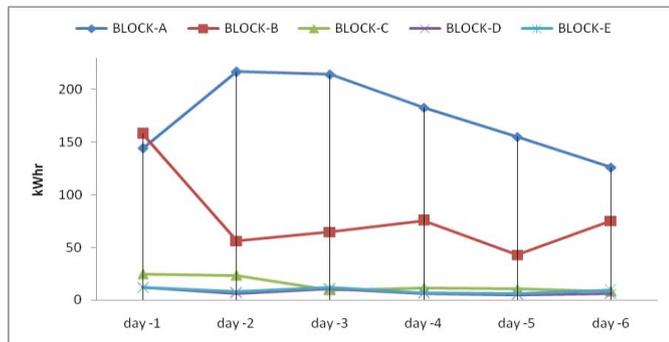


Fig-(4) Power consumption in different block per day

The **fig-(4)** represents the maximum power consumption in **block- A** which is approximately 225kwhr in a day. The graph represents that the **block-B** having the average consumption among all the blocks. The **block-C, block-D** and **block-E** have low consumption below 50kwhr.

Table-(2): - power consumption per day

day -1	day -2	day -3	day -4	day -5	day -6
350.434	310.56	311.109	282.875	219.408	224.625

The **table-(2)** represents all the blocks power wastage added together for six days. From this we calculated the actual power consumption per day. The data of day-1 consumption is maximum. When it is converted into rupee it will figure out as 2277 rupees. Day -2 and 3 is having the average wastage as 310kwhr and 311kwhr (unit). Here the cost will come as 2000

rupee approximately. The day-5 is having the minimum consumption and least cost.

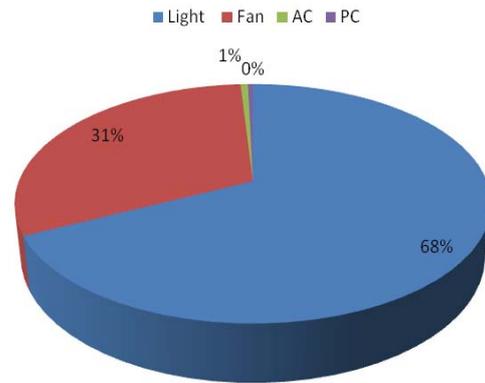


Fig-(5) Appliances percentage

The pie chart represented in **figure-(5)** shows appliance wise distribution. The light is contributes 68% wastages, Fan 31%, whereas PC and AC having the negligible wastages.

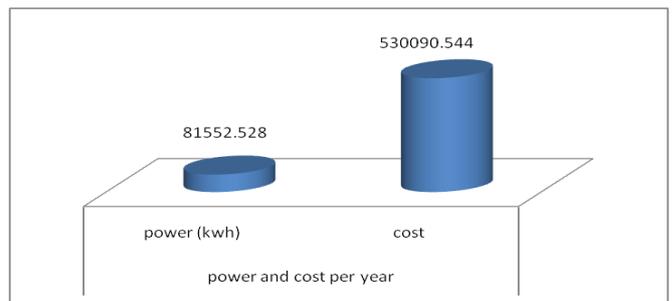


Fig-(6) Power & cost per year

The **figure-(6)** represents the value of power wastage per year and its cost. The overall cost university is paying on wastage is 5lakhs 30thousand per year. The weekly and the monthly expenses is Rs 11043 and Rs. 44174 respectively.

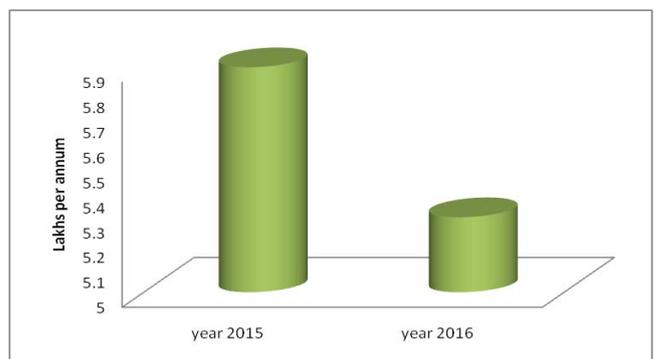


Fig - (7) Comparison graph of wastage audit

The **fig-(7)** represents the wastage cost for years 2015 and 2016 respectively. Both the year is having difference of 60000 rupee approximately. It s observed comparison of both the pie chart, the wastage is occurring majorly by light and fan throughout both the year and the comparison graph of wastage audit expenses of both the year represents that every year university is paying above 5 lakhs per year on wastage power.

so, for these issues a strong recommendation is needed and should have to implementation immediately.

IV. ISSUES AND RECOMMENDATIONS

The wastage audit was conducted and the following issues were observed for necessary action. The issues are ordered in the ranking for priority implementation.

- No efforts for conducting Energy Awareness program in University. 80% of students do not switch off the fans and lights during lunch hours and after 4:00 p.m.
- 70% of fans and lights are not cleaned weekly.
- In some Blocks 90% of equipments are not star rated.
- After lab classes 75% students and lab In charges do not turn off the systems.
- It is observe that the 85% of same watts of bulbs are using in each blocks.
- It is observed that 65% of machines are 15 years old.
- Through a single switch 35% of fans and lights are connected.
- In some offices 10% of staff are not turning off the AC and lights while leaving the office.
- Lack of knowledge 5% of staffs turn ON the outdoor light before the sunset.

After several brains storming sessions, six recommendations are suggested for implementation to reduce the wastage power to zero percentage. The detailed discussions are presented below.

A. ESA PROGRAM

The University is committed to assigning a highly responsible student as Energy Saving Ambassador (ESA). The recruitment ambassador program jointly organized by the Vision 10MW and supports the university to decrease the power wastages. The Vision 10MW call for nomination comes to all the interested students and to get finalize list of Ambassador. After the selection the Ambassador, they will wear the specials dress which is provided by the Vision 10MW Department. The Energy saving Ambassador (ESA) monitor their respective blocks regularly and switch off the electrical equipments which are not in use. These activities have to post in the energy saving app.



APP: - This app was developed by the MGR VISION 10 MW Members. The objective of the app is to monitor the wastage energy and provide the critical analysis and report on best performer, who saved more units. The Ambassador educates the mentors and non-teaching staffs about the wastage in their respective blocks. They ESA are will be evaluate by the directly of Vision 10MW all Thursday and they regularly mark. The Ambassador have to regularly updates the saving activity in the app, the best performer can rewarded by Rs 1000 monthly, and the worst performer will be thrown out the system.

B. e-Man

It is identified that some of the areas of our country is suffering from energy crisis. There the demand is more than the production. For that government have to do load shading in those areas. The areas where the production is more than the demand there the people are not caring about switching off the appliances. Thoughts in that are the people become lazy and don't want to leave their comfort level. To resolve this issue immediate action should be taken and implemented very urgently. It is suggested to recruit one person with monthly salary of 5000 having basic electrical ITI degrees. The name of the recruited person is E-MAN. His out-look have to represent the energy saver. Duty of that person allotted from 8:30 am to 8:30pm. His duties are to monitor 4times in a day and note down the responsible person for the wastage and end of the day report to the director of vision 10MW. After director will send warning letter to the responsible person for wastage. After 3 warnings he will take the action on the responsible person. After this implementation 50% expectation of energy saving. The estimate cost is 60000RS per annum.

C. AUTOMATION:

Lighting Automation: People are not aware about the power wastage. It is observed that in a summer days the lights are switched ON at 5:30pm instead of 6:15pm. To resolve this issue to save the unwanted power LDR automation is recommended. LDR, photoconductor or photocell is a device which has a resistance which varies according to the amount of the light falling on the surface. LDR or light dependent resistors are very useful especially in light/dark sensor circuits. It will automatically switch ON the light with respect to the light available in atmosphere. Through this implementation 25 street light and 50 outdoor lighting systems are recommend for automation. The 5% of energy saving from the energy wastage.

Class Room Automation: It is observed the students are not aware about the power wastage, sometimes two or three students are in class, but all the fans are switched ON. During the day time lights are not needed instead of that the lights are also switched ON. It is suggested full automation for the classroom to control fan and light. The light will be switched ON based on the no. of students and the outside temperature and appearance of the room. The fan will be switched ON based on the no. of students and the temperature of the room.

Water Pump Automation: Another issue observed is the overflow of the water, in over head tank. There are six water pumps in the university and it is observed that 25% time's water got overflow. So, it is recommended multilevel automation to control all the pump motors. Estimated cost is 10 thousand.

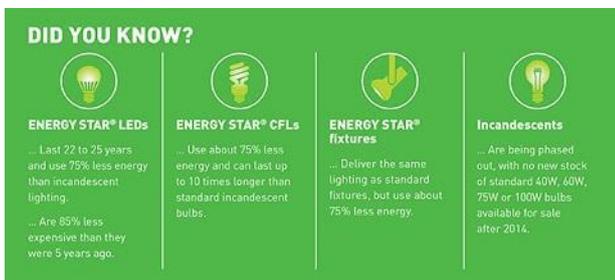
D. REARRANGEMENT

It is identified that maximum no. of light and fan are operated by a common switch. It is also observed that maximum no. of lights are available at some places where minimum no. of lights are required. Some laboratory lights are improperly placed. Each fan and light should be operated from separate switch which will reduce light (power wastage).The rearrangement of the light is necessary to the reduction of power wastage, i.e., in present 10 lights are operated for a room but it will rearranged then 8 lights are sufficient for the one room. So, two lights are reduced and power saved from power wastage. One common breaker should be available for each room. It will turn OFF all the equipments power. Estimated cost is 20 thousand.

E. WASTAGE REDUCTION AWARENESS PROGRAM

Awareness means the ability to directly know and perceive, to feel, or to be conscious of events, objects, thoughts, emotions, or sensory patterns. By this meaning we have to do serious and strong awareness program to raise the student, faculty, staffs, workers and all the citizens of our country about their responsibilities to save earth. The save energy awareness program shows their role about to save earth. Today there are very few who do their duties in sense to save wastage of energy and save earth. For this the wastage reduction awareness program is important. The main motto is to create consciousness for save wastage of energy. In the awareness program there is lots of thing we can do like: - pamphlets, banners, posters, drama, promotional videos etc.

Pamphlet promotion: There are 9-10 thousand students in our university for that we print the pamphlet and distributed among all of them and explain about the importance of energy saving. Inside the pamphlet energy saving quotation and its importance is mentioned and we explain them their duties towards the save energy awareness program.



Banners and Poster: Banners play very important role in any awareness program. It is a big representation of any activity. In that we use save energy picture and small notations which gives strong message among all of them. We use posters for the promotion and go to every class and tell the message to everyone. In that poster the energy saving messages is present.



2min. Video: Video is a digital medium which is used widely now days for promotion. In that we do drama and something related to the energy saving awareness program. It is 2-3 min video in that we show the reality and after implementing the energy saving guidelines what result will come. Videos make different impression and consciousness. These all are the medium to widen the awareness program. Today's world is technical world we use social media like what's app, face book etc to connect with everyone and promote this awareness program faster than the other medium. We go through by online or offline competition it increase enthusiasm among all of them. By this methodology we save 5-10% of power out of 100% wastage.

F. COST and SAVING ANALYSIS

After implementation of these recommendation the following percentage of power saving we can expected with the minimum of investment Rs 50,000 per annum and savings of Rs 540000.

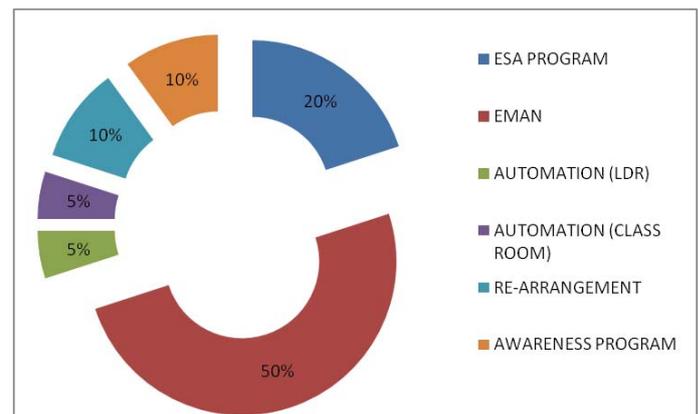


Fig - (7) Cost and saving analysis by different recommendations in percentages

V. CONCLUSION

The power wastage audit executed successfully with the strong recommendations. Five types of recommendation like ESA Program, EMAN, Automation, Re-Arrangement, Wastage Reduction Awareness program suggested for implementation. The universities implemented the recommendation and achieved 95% saving. The authors

advised all the institution to implement the recommendation for power wastage saving.

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