

WASTE MINIMIZATION INITIATIVES AND ENERGY CONSERVATION IN HOTEL INDUSTRIES

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ABSTRACT

A safe, efficient waste management system is a crucial aspect of any hospitality business. Hoteliers have many opportunities to reduce waste by utilizing waste audits to establish waste prevention and recycling programs and by purchasing recycled products using a retail waste management program. Besides reducing waste and saving money, these actions can increase employee morale and customer satisfaction as well as lower dumpster costs and create strong relationships with the managed haulers. When it comes to waste disposal and waste management, those in the hospitality industry experience a unique set of challenging needs. Keeping this in mind our research work would enable the hotel operators to achieve better maintenance effectiveness and efficiency through various strategies and cost index, which appear not to be widely available in the market. The quantitative research methodology of the survey is conducted in major hotel operators in Mysore.

Keywords: Waste Minimization; Recycling; Energy Conservation; Retail waste management program:

INTRODUCTION

It is important, in the hospitality waste management [01] environment that business comes across as a professional and clean environment to all patrons. Furthermore, due to the increasing safety requirements of the industry, it is extremely important that the waste disposal equipment, including dumpsters and roll-offs, be easy to operate and maintain all while meeting the required safety regulations. Be it a nationwide hotel chain, or an individual hotel, a safe, efficient waste management system is a crucial aspect of any hospitality business. Although waste is clearly a big issue for hoteliers, examples of good waste management practice can be found across the hospitality industry. This range from environmentally enlightened individuals at small establishments 'doing their bit', to well orchestrated systems within international groups. What many of them share is the knowledge that landfill capacity around the world is diminishing as

rapidly as the costs are escalating, that incineration is not always an option, and that waste legislation is becoming increasingly tough.

To take on these issues it is important to utilize waste brokers, trash brokers, managed haulers, and waste outsourcing services to maximize trash and waste spend. In addition, many items that are thrown away can have an afterlife when reused or recycled into something else. In the hospitality industry, we should focus on providing recycling and waste solutions to insure waste optimization for hotels and restaurants of any size and waste focus designed to optimize the waste needs and the waste spend. Waste management solutions that can operate inside or outside depending on individual needs and building configuration. For the better waste management solution following aspects should be taken.

- Management should adopt an environmental policy to reflect how the company sees itself in relation to the environment, neighbors, and the people it employs and serves. Chains with multiple locations may want to encourage each hotel to evaluate and establish its own program.
- For waste management program to be successful, designate an account manager who will be the single source of contact. All locations and haulers and dumpsters and roll-offs will be managed through the account manager whose main focus is to make sure we are both saving as much money as possible.
- Conducting a waste evaluation as well as a waste audit to identify waste prevention ideas and estimate the amount of recyclable materials generated at your hotel.

WASTE MANAGEMENT

Waste management [02] is the "generation, prevention, characterization, monitoring, treatment, handling, reuse and residual disposition of solid wastes". There are various types of solid waste including municipal (residential, institutional, commercial), agricultural, and special (health care, household hazardous wastes, sewage sludge). The term usually relates to materials produced by human activity, and the process is generally undertaken to reduce their effect on health, the environment or aesthetics. There is a wide array of issues relating to waste management and those areas include:

- Generation of waste
- Waste minimization
- Waste removal
- Waste transportation
- Waste treatment
- Recycling and reuse
- Storage, collection, transport, and transfer
- Treatment
- Landfill disposal
- Environmental considerations
- Financial and marketing aspects
- Policy and regulation
- Education and training

- Planning and implementation.

Waste management practices are not uniform among: countries (developed and developing nations); regions (urban and rural area), and sectors (residential and industrial) [03][04][07].

A. ***Waste comes in many different forms:***

- Agricultural waste
- Animal by-products
- Biodegradable waste
- Biomedical waste
- Bulky waste
- Business waste
- Chemical waste
- Clinical waste
- Commercial waste
- Composite waste
- Construction and demolition waste (C&D waste)
- Consumable waste
- Domestic waste
- Electronic waste (e-waste)
- Food waste
- Gaseous wastes
- Hazardous waste
- Household waste
 - Household hazardous waste
- Human waste
 - Sewage sludge
- Industrial waste
 - Slag
 - Fly ash
 - Sludge
- Kitchen waste
- Litter
- Packaging waste
- Post-consumer waste
- Recyclable waste
- Sewage and many more

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[8] [6]

A. ***Sewage Treatment Plant***

Most of the hotels had sewage treatment plants on the premises. All waste water generated in these hotels was treated and used for gardening.

B. Biogas Generation

The survey revealed that only 13 percent of the hotels used kitchen waste for biogas generation while the remaining disposed it to piggeries. According to the management of hotels with biogas plants, they recovered the investment made on these plants in just one to two years.

C. Solid Waste Segregation and Recycling

Almost all hotels (90 percent) segregated their waste through various means before disposing. Waste such as paper, plastic, metal, and glass were separated and sold to a third party for recycling.

D. Composting of Garden Waste

Twenty-two of the surveyed hotels composted garden waste on the premises. Installation of Capacitor Banks. The most upgraded hotels (56 percent) had installed capacitor banks to improve power factor. After installation of capacitor banks, hotels recorded an improvement in power factor from 0.80 to 0.98. This had resulted in reduction of electricity bills. While costs vary according to size, typically, installation cost of one kilo volt ampere reactive capacitor bank is around \$28 with an estimated payback period of one to two years.

E. Installation of Solar Photovoltaic Panels for Guestroom Lighting

Two hotels had installed small solar photovoltaic (PV) systems for guest room lighting with back-up connectivity to grid supply during bad weather. Capacity of solar PV systems in the surveyed hotels was in the range of 10 to 20 kilowatt. Investment incurred for a 20 kilowatt solar PV system is around \$63,000 to \$79,000 with an estimated payback period of 16 to 20 years.

F. Installation of Energy Efficient Water Heating Systems

Installation of Solar Water Heaters: Fifty-two percent of surveyed hotels had installed solar water heaters to heat water. The hotels replaced electric heaters or reduced fuel consumption of steam boilers. Most hotels had installed solar water heaters with a capacity of 300 liters per day, which in turn can serve multiple rooms. The cost of a solar heater of 300 liters per day is around \$2,362 with an estimated payback period of five to six years.

G. Installation of Biomass Gasifiers/Biomass Boiler

Six of the surveyed hotels (26 percent) had installed biomass boilers or biomass gasifiers to reduce diesel and furnace oil consumption. Steam generated from these systems heated water for guest rooms, laundry, and kitchens. The size of biomass gasifiers was in the range of 180 to 900 kilowatt thermal. In some hotels, the capacities of the biomass boilers were in the 1 to 1.5 tons/hr. range. The cost of a biomass gasifier of 300 kilowatt thermal is around \$30,000 with an estimated payback period of one to two years.

H. Central Air Conditioners

Some hotels had replaced existing chiller plants with Coefficient of Performance of less than three, with energy efficient chiller plants with Coefficient of Performance of more than seven. One hotel replaced a 185 TR chiller with an energy efficient chiller and reduced electricity consumption from 1.2 kilowatts per TR to 0.60 kilowatts per TR. The investment was around \$80,000 with an estimated payback period of 1.5 years with 18 operating hours per day. Several hotels have implemented similar measures with chillers of different capacities.^{[3][4]}

CASE STUDY

From the above explanation it is clear that there is still much scope is available to implement the waste management techniques in hotel industries & also to use the alternate energy resources. Having said that there is still much data and survey is required to implement the above statement. Once the proper data is obtained, steps can be taken to segregate, eliminate & to use alternate energy fuels.

Keeping this in Mind, our study is conducted in selected hotels of Mysuru to obtain the data to minimize the waste, to conserve the energy and to improve the overall efficiency. Some of the key areas are identified which contribute to waste management & utilizes the maximum energy resources which mentioned below. Food & beverages, In-Room Amenities, Lodging, Water supply, Lift Movement, Power supply & lighting systems [05].

For the selected hotel, the usage of energy i.e. the main energy resources used are Electricity (61%) and Natural Gas & Other Fuels (39%) which are shown in Figure 1.

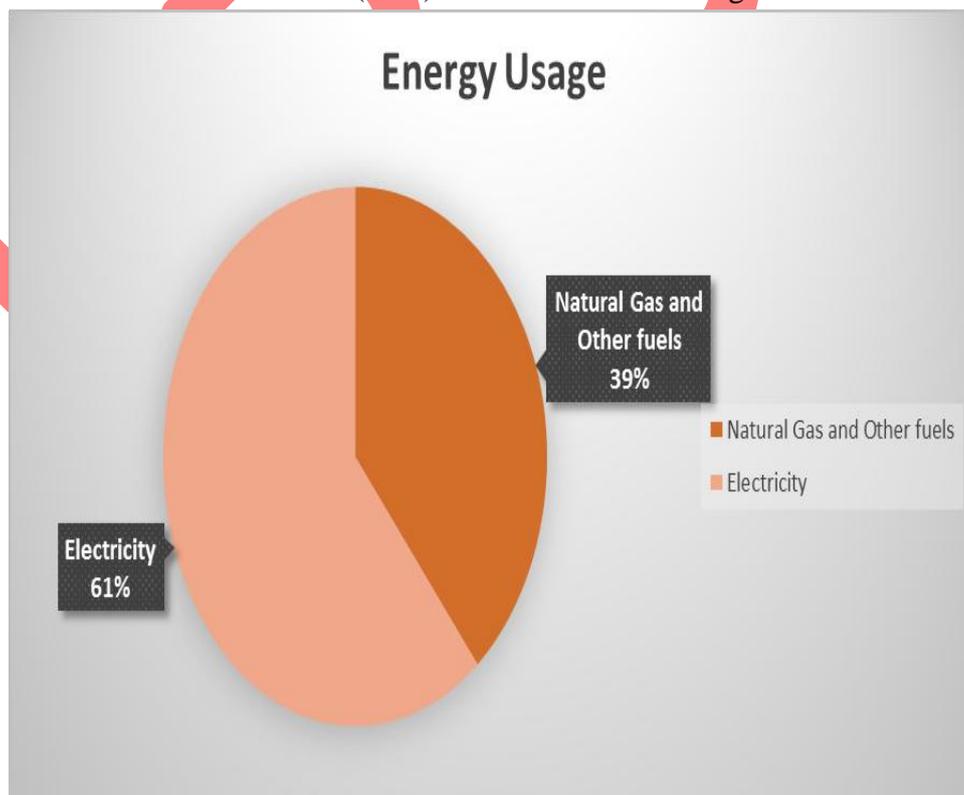


Figure 1. Energy Resources used.

Similarly, the utilization of energy for different areas are Lighting (12%), Other(9%), Cooking (5%), Office Equipment (5%), Ventilation (4%), Refrigerator (3%), Space Heating (30%), Water Heating (17%) and Cooling (15%) which are shown in Figure 2.

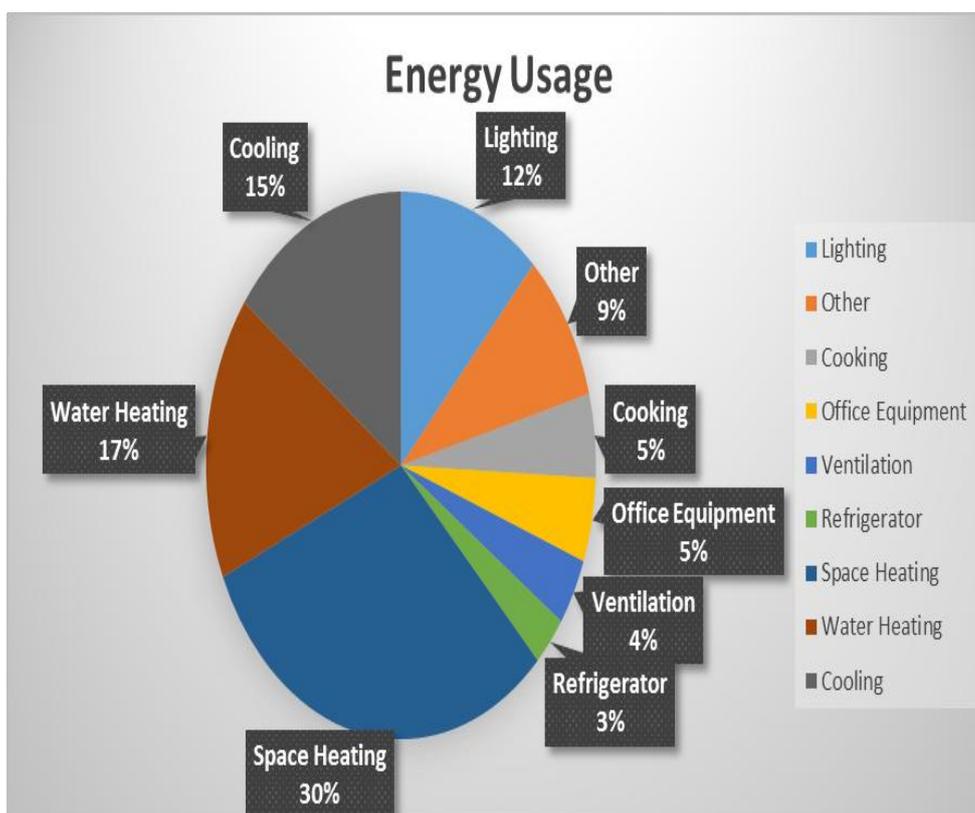


Figure 2. Energy usage in different areas.

The different types of energy i.e. Conventional and Renewable energy, its usage and source of these energy are shown in Table 1.

Table I. Energy Resource Consumption in Surveyed Hotel.

Type of Energy	Total Usage	Source
Conventional Energy		
Electricity	50KVA	KEB
Electricity	62.5 and 125 KVA	Captive diesel generator
Liquefied Petroleum Gas	678 Tones	Petroleum Corporation
Diesel	1,060 Thousand Liters (including electricity generation)	Petroleum Corporation
Furnace Oil	1,404 Thousand Liters	Petroleum Corporation
Renewable Energy		
Solar	50 Megawatt hours	Solar photo voltaic

A. Suggested method for the Hotel

After going through all the details, many measures have been taken in the surveyed hotel to improve the overall efficiency. The details of it are given in Table 2.

Table II. Identified Resource Efficiency Measures in Surveyed Hotel.

<i>Resource consuming</i>	<i>Resource</i>	<i>Efficient Solution</i>
<i>Air-conditioning</i>	<i>Energy</i>	<ul style="list-style-type: none"> ➤ <i>Energy efficient (high EER) split air conditioners</i> ➤ <i>Energy efficient (high coefficient of performance) centralized</i> ➤ <i>chiller plant</i>
<i>Lighting</i>	<i>Energy</i>	➤ <i>Installation of CFLs, LED lamps, T5 fluorescent tube lights</i>
<i>Hot water and laundry</i>	<i>Energy and water</i>	<ul style="list-style-type: none"> ➤ <i>Installation of solar water heaters</i> ➤ <i>Installation of biomass gasifier / biomass boiler</i> ➤ <i>More efficient laundry equipment</i>
<i>Motors and pumps</i>	<i>Energy</i>	➤ <i>Installation of variable frequency drives</i>
<i>Demand reduction</i>	<i>Energy</i>	➤ <i>Installation of capacitor bank</i>
<i>Toilets and bathrooms</i>	<i>Water</i>	➤ <i>Efficient water fixture (Low flow taps and showers, Dual flush)</i>

After implementation of all the suggested measures, it is found that appreciable savings of energy in different areas in the surveyed hotel. The details of it are given in Table 2

Table III. Potential Energy Savings in Different Areas.

<i>Particulars</i>	<i>Total savings potential</i>	<i>Percentage savings potential of total consumption</i>
<i>Electricity savings (Megawatt hours/Year)</i>	<i>6320</i>	<i>10.5</i>
<i>Diesel savings (Thousand Liters/Year)</i>	<i>261</i>	<i>25</i>
<i>Furnace Oil savings (Thousand Liters/Year)</i>	<i>386</i>	<i>27</i>
<i>LPG savings (Tones/Year)</i>	<i>37</i>	<i>5</i>
<i>Water savings (Thousand m³/Year)</i>	<i>125</i>	<i>8</i>
<i>Particulars</i>	<i>Values</i>	
<i>Total estimated investment required (million \$)</i>	<i>4.76</i>	<i>-</i>
<i>Reduction of tones of CO₂ emission</i>	<i>5952</i>	<i>-</i>

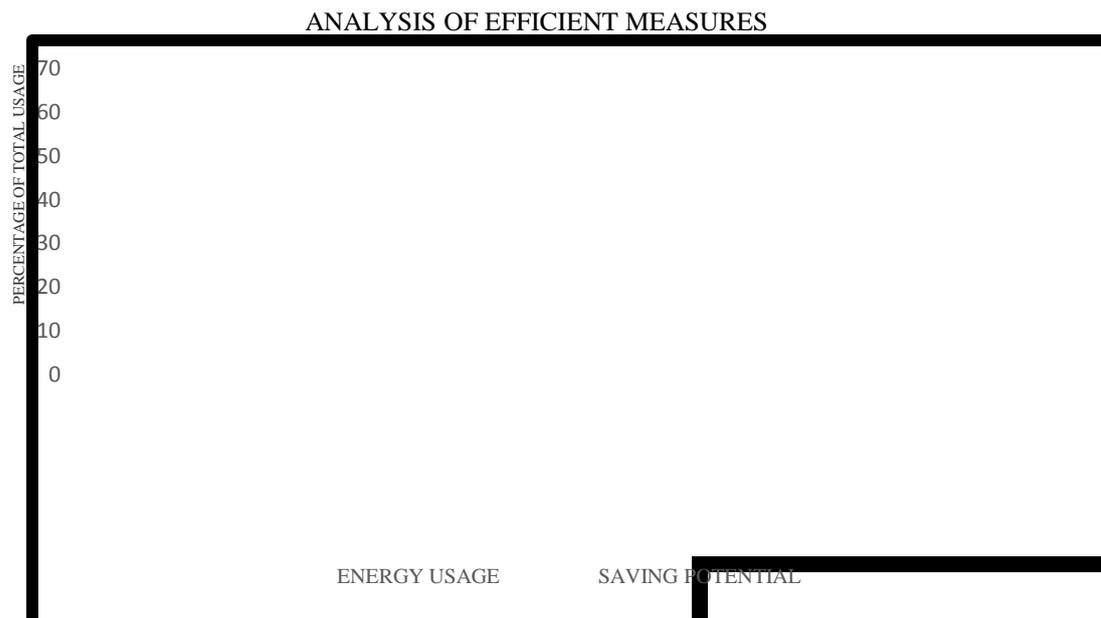


Figure 3. Energy Consumption area.

The graph is plotted Usage of Energy in different areas versus Percentage of total usage before and after the implementation of the suggested measures. It is clear from the Figure 3 that, after the implementation there is a subsequent reduction in the usage of energy is noticed in the surveyed hotel.

CONCLUSIONS

- Solid waste generation in hotels is primarily from the kitchen, guest rooms and gardens. Waste generated from food is the major contributor to total solid waste followed by garden waste (12 percent). Others include plastic, glass, and metal (five percent) and paper and cardboard with four percent.
- Air conditioning has the highest potential for electricity savings (70 percent of total estimated electricity savings potential) followed by lighting, including installation of solar PV (15 percent), hot water and laundry (10 percent) and motors and pumps (five percent).
- Toilets and bathrooms have the highest potential for water saving (50 percent of total estimated water savings potential) followed by sewage treatment plants (46 percent) and hot water and laundry (five percent).
- Resources such as energy, water, and waste management together are a significant portion of the total operating costs of hotels. On an Average, these constitute 20 to 30 percent of the total operating costs of a hotel.

REFERENCES

- [1] Ray, A. "Waste management in developing Asia: Can trade and cooperation help?", *The Journal of Environment & Development* 17.1 (2008): 3-25.
- [2] "Solid Waste Management." 2005. United Nations Environment Programme. Chapter III: Waste Quantities and Characteristics, 31-38.
- [3] Sharholy, M., Ahmad, K., Vaishya, R.C., Gupta, R.D., "Municipal solid waste characteristics and management in Allahabad", 2009, India. *Journal of Waste Management* 27, 490–496.
- [4] Sharholy, M., Ahmad, K., Mahmood, G., Trivedi, R.C., "Municipal solid waste management in Indian cities. A review", 2008, *Journal of Waste Management* 28, 459–467.
- [5] Shekdar, A., "Sustainable solid waste management: an integrated approach for Asian countries", 2009, *Journal of Waste Management* 29, 1438–1448.
- [6] Coyle, J.J., Bardi RJ & Langley CJ, "The Management of Business Logistics", Wset Publishing CO St Pauls M N, 1992.
- [7] Wilson D.C, Velis, C, Cheeseman, C, "Role of informal sector recycling in waste management in developing countries", *Habitat International* 30 (2006): 797-808
- [8] <http://www.lincolnwaste.com/hospitality-waste-management.html>