Some Proposals Suggested for Achieving Sustainability of Resources and Energy in the Hotels of Jordan

The Hashemite University

Authors
Dr. Omar Shdeifat
Dr. Mousa Mohsen
Dr. Mairna Mustafa
Dr. Yahaya al-Ali
Mr. Bassam al-Mheisen

LIFE Third Countries
Development of Methods and Tools for the Establishment of Good Environmental Performance in the Tourist Accommodation Sector in Jordan – Implementation of pilot studies
GREEN-TAS
# Table of Contents

1. **Introduction** ........................................................................................................... 2
2. **Why Should We Consider the Issues of Energy and Resources?** ............... 3
3. **Factors Affecting the Environmental Impacts & Consumption of Energy in Hotels** .......................................................................................................................... 5
4. **Proposals for Improving Environmental Behaviour, Resources Consumption & Energy Efficiency** .................................................................................................. 7
   4.1 Proposal 1: Energy Consumption ............................................................................ 8
   4.2 Proposal 2: Water Management ........................................................................... 30
   4.3 Proposal 3: Solid Waste Management .................................................................. 36
   4.4 Proposal 4: Awareness of Staff and Guests .......................................................... 38
   4.5 Proposal 5: Landscape Surrounding the Hotels .................................................... 52
5. **Sub Metering and Monitoring** ............................................................................. 53
6. **Some Other Problems Faced by Hotels in Jordan** ............................................ 55
7. **References** ............................................................................................................. 57
1 Introduction

Although of the great importance of hotels in the tourism industry as a main provider of services to tourists, and a great generator of income and job opportunities; the negative impacts they cause can not be ignored. Hotels in general overuse fresh water sources for its pools, golf courses and for irrigating their green areas (if existed). Hotels in general overuse fresh water sources for the personal use of guests; they also contribute to the generation of waste water and solid waste. In some cases, they result in producing toxic waste because of overusing chemicals in some operations, as in laundry. Regarding the surroundings of hotels, the impact would depend in this case on the geographical location of the hotels. Some hotels on sea shores highly contribute to the damage of coral reefs and marine life; and might cause degradation of landscape through their construction if it was not planned in a sustainable manner. Hotels in wildlife areas highly cause the disturbance to their species; and when being located near to historical and archaeological sites, they might increase the opportunity for their degradation.

Another important issue is the high contribution to the overuse of energy sources (such as electricity), which is the issue to be discussed here in this report. This report is composed of gathered information regarding the best practices and implications that can be taken by hotel management to increase energy efficiency, which will help consequently in reducing costs of using energy and protect the environment from any negative impacts that might occur.

This report is basically a number of proposals; these proposals include a number of recommended procedures to be taken to solve some problems in hotels regarding sustainability of resources and environmental performance. Problems were recorded after a number of field visits and some interviews with people working in hotels. Also, the results of the surveys in D2 of Task 1 were used as well, which is mainly to give a kind of evaluation for the problems faced by hotels in Jordan. There was a special focus on the three top ratings of hotels regarding the scores for items in the survey of D2/Task 1, these were mentioned and used for the purpose of this report.
2 Why Should We Consider the Issues of Energy and Resources?

Hotels and other types of accommodations are considered as one of the main services’ providers in tourism sector. Hotels use significant amounts of energy for daily operations and recreational activities. (UNEP 2002)

Building climate control and general services in the hotel are composed of passive cooling, energy management and control systems (EMCS), distributed and central cooling system, ice storage, and desiccant dehumidification, occupancy sensors / key cards, that is in addition to laundry and kitchen equipments. (ESCWA 2003)

In many facilities, energy costs are the second-highest operational costs after payroll.

Such considerable cost of energy is due to using technology and different sources of energy to provide comforts and conveniences to hotel guests. The vast majority of hotels and resorts meet their energy needs by purchasing energy produced through the burning of fossil fuels (coal, oil and natural gas), such processes are main contributors to different kinds of environmental pollution and global climate change. (UNEP 2002)

Electricity and thermal energy are the main energy forms used in the tourism facilities for necessary services. Electricity is used throughout the tourist accommodations for several tasks, including lighting, water heating, air conditioning, plumbing, laundry operations and desalination. The thermal energy is mostly used for hot water in guestrooms, the kitchen and the laundry.

The electricity energy is usually provided through grid connection, diesel generators, gas turbines, photovoltaics, wind electric systems, hybrid systems and solar thermal. The thermal energy sources include petroleum-based fuels, solar water heating, waste heat / cogeneration, hot water storage and seawater active / passive. (USAID 1991)

Since such energies are depending directly or indirectly on burning fossil fuels to run different kinds of operation, it means then a business expense through the cost of energy, and not less important a significant cause of degradation to environment and to the community.
Consequently, there are several benefits that can be gained through improving energy consumption in hotels and other different tourism establishments, according to (ESCWA 2003); these can be listed as follows:

- Reduced resource consumption and reduced costs.
- Customer loyalty and enhanced public image.
- Attracting and retaining dedicated staff.
- Avoid sanctions from environmental authorities.
- Improve competitiveness in the world markets.
- Long-term business benefits.
3 Factors Affecting the Environmental Impacts & Consumption of Energy in Hotels

Due to the high diversity of energy consumption in tourism and hospitality sector, most hotel facilities only monitor their energy expenditure without detailed attention to the specific consumption of the different end-use applications. The typical energy loads and consumption in tourist facilities would be affected by a number of operating conditions or factors, including, the size and luxury level of the hotel, climatic conditions, location (remote / rural or urban), guest profiles (visiting or vacation guests), and types of services / activities.

Other important factors are the age and condition of the energy systems, which affects their efficiency. Such operating conditions can be classified into three main groups: (as quoted from the report of ESCWA 2003)

(a) Facility Characteristics including:

☑ Type of facility “urban hotels, vocational villages, restaurants, etc”,

☑ Facility category (1-5 stars), and size (number of guest rooms) and the facility area.

(b) The facility site, the location of the tourist facility mainly affects:

Climatic conditions, consequently the peak load time and the level of energy consumption particularly for space climatization, and water heating. It also affects the types of the available energy supply options on or nearby the site.

(c) The facility zoning areas, a hotel can be divided to three distinct zones all serving distinctly different purposes and utilizing different forms and level of energy:

☑ The Guest rooms area: includes (bedrooms/ bathrooms), individual spaces, which are often with varying energy loads according to occupancy rate and type of guests.

☑ The Public area (reception hall, loopy, restaurants, meeting/ banquet rooms, swimming pool, health clubs or gyms, etc.), with a high rate of heat exchange with the outdoor environment (high thermal losses) and high internal loads (occupants, appliances/equipment, and lighting).
✓ The Service area (kitchen, offices, store rooms, laundry facilities, machine rooms, elevators and escalators) – energy-intensive areas typically requiring advanced air handling (Ventilation, cooling, heating). (ESCWA 2003)
4 Proposals for Improving Environmental Behaviour, Resources Consumption & Energy Efficiency

By looking at these factors, it can be indicated that improving environmental performance and energy consumption, which are problems in to be seen in most of hotels in Jordan, may become achievable through some main approaches, which are clarified through the following proposals:

1- Energy Consumption
2- Water Management
3- Solid Waste Management
4- Awareness of Staff and Guests
5- Landscape Surrounding Hotels

Each of these proposals include a description and an evaluation for some specific problems taking place in Jordanian hotels, this was based on a number of field visits and the data collected in D2 for Task 1. This information is then followed by some suggested solutions that might help in reducing these problems.
4.1 Proposal 1: Energy Consumption

One of the main problems facing hotels in Jordan is the high consumption of energy caused by HVAC systems and lighting, as well as other equipments in different departments; this is due to the lack of insulation techniques in most hotels, as well as the lack of sensors sensitive to the presence of individuals within rooms or any areas in hotels.

Another important issue in Jordan hotels is the great consumption of energy and fuels caused by heating water and heating systems; this is due to the lack of insulation techniques as well as the lack of using solar system and other types of renewable types of energy sources.

The results of (D2/Task 1) show that 71.7% of all hotels apply some energy conservation practices in their hotel while 95.2% of five star hotels apply such practices, 87.5% of four star hotels, and 62.3% of one star hotels. About 60.6% of classified hotels have an energy usage plan with specific savings goals: 75.0% of five star hotels and 91.3% of four star hotels do have an energy usage plan with such goals, while 37.7% of one star hotels do have it.

It was also found that more than 59% of all hotels installed equipments to reduce energy consumption for heating, ventilation, air-conditioning in their hotel while 79.2% of four star hotels installed such equipments, 71.4% of three star hotels, and 55.3% of five star hotels.

Most of the hotels in Jordan (74.9%) are willing to great extent to reduce energy consumption by using energy efficient appliances. 85.7% of five star hotels are willing to great extent to do so, as well as 83.3% of the four star hotels. while 62.3% of one star hotels as willing to reduce energy consumption to a great extent.

Most of these hotels are regularly monitoring their consumption of energy as well as water.

In addition to results mentioned above, it was found that 16.1% of hotels said that they already installed a power monitoring system in their hotels. While 40.2% of all hotels said that they are "not very willing and not at all willing" to install a power monitoring system in their hotel to better protect the environment.
One of the real challenges facing hotels anywhere is reducing the costs of using energy while satisfying the needs of customers. This can be possible by using proven energy-efficiency measures; it was found that hotels could cut energy costs by 20 percent or more by such implication. Major energy expenditures in hotels include lighting for guest rooms and common areas, heating, ventilation and air conditioning systems (HVAC) and motors in equipment such as elevators. (http://www.ase.org/section/topic/ee_hotels/)

In general, some procedures can be applied in order to reduce the costs of such expenditures, such as proper adjustment of temperature controls and shutting of equipment when it is not in use, also low-cost measures such as key switches that automatically shut off power to a guest room when not in use and high efficiency lighting, to high-cost options such as cogeneration and waste heat recovery systems. Some of these measures are a combination of both energy improvements with conservation of other resource. (ESCWA 2003)

The following is a more specific description about the situation in Jordanian hotels and how to reduce the costs of energy consumption and expenditures in different services and facilities in hotels:
4.1.1 HVAC Systems

After a number of field visits to a number of different classified hotels, it was found that hotels in Jordan are not using any kinds of sensors to control usage of HVAC systems in guests' rooms, their thermostats are usually located in guests rooms, though, public and service areas in some 5 star hotels are supplied with monitors to control the use of such devices.

Sensors in room windows to turn off AC when the window is opened
(a guest room in a five star hotel)

Ventilation used in a 4-star Hotel in Jordan (Lobby Area)
An HVAC in a 4-star hotel room in Jordan (Guest Room)

An HVAC thermostat in a five stars hotel in Jordan (Guest Room)
Heating, ventilation, and air conditioning (HVAC) systems are usually seen as the largest electricity consumers in hotels. It was estimated that the amount of electricity used for running air conditioning systems is composing approximately 30% or more of total expenditures of energy consumption. HVAC systems provide heating, cooling, humidity control, filtration, fresh air, building pressure control and comfort control. Properly-operating HVAC systems contribute to employee productivity and guest satisfaction. Upgrading controls or replacing outdated HVAC are practical strategies that can effectively reduce operation costs.

The followings are some practical implications that can improve the efficiency of HVAC system:

- **Insulation:** when insulating all heating and cooling lines/vessels using appropriate insulation thickness, minimizing heat gains or losses becomes possible.

- **Building Envelope:** measures as false ceilings and segregation of critical areas for air conditioning by air curtains all can optimize the effective space requiring air conditioning.

- **Building Heat Load Minimization:** Minimizing the air conditioning loads can be done by some procedures as roof cooling, roof reflectance, efficient lighting, and optimal thermostat setting of temperature of air conditioned spaces, sun film applications, etc.

- **Solar Heat Gain Control:** Such control can be achieved by installing awnings, overhangs, or low e-coated windows with low Solar Heat Gain Coefficient (SHGC).

- **Select high-efficiency units when replacing HVAC equipment:** Although some high-efficiency units may be more expensive than average-efficiency units, the higher initial payment can be recovered through increased energy savings in a very short time.

- **It is necessary to conduct a proper maintenance of HVAC systems,** such as cleaning filters and maintaining proper refrigerant charge on wall units and packaged systems. (http://www.ase.org)
It is not only during the operation process when it is needed to consider the efficiency of HVAC system, even during the stage of design, designers should follow the whole building approach, where building and energy designs are integrated, and to incorporate passive features as appropriate in the building design. Designers should also put in mind all available building design options including passive and active solar designs, using most efficient and most reliable conventional systems; such systems include (as listed in ESCWA 2003): double- or triple-glazed low emissive insulating windows, reflective coating or windows, and insulated doors; high-pressure water atomization instead of compressed air humidification for substantial energy savings, self-regulating controls for ventilation systems, interconnecting the controls for spaces with separate heating and cooling systems to prevent simultaneous heating and cooling, installing load analyzers in the controls of multi-zone and dual duct systems to optimize hot and cold temperatures, installing load analyzers in the controls of terminal reheat systems to optimize the supply air temperature and minimize the reheat control, installing time clocks to shut down the air system or switch to 100% recirculation in unoccupied spaces, installing control interlocks to shut down heating or cooling system pumps when output is not required, installing economizer controls on central air systems to use outdoor air as a replacement to refrigerated cooling when appropriate, installing automatic control valves at unit heaters and fan-coil heaters to shut off water or steam flow when fans are not running, installing variable speed drives to centrifugal chillers (if used), which save up to 40% compared to a conventional chiller, installing energy management and control systems for controlling temperature, humidity and time of day for meeting rooms, guest rooms and other public areas, and installing high efficiency HVAC systems.

After the process of installation of previous systems is done, managers and staff have the ability to increase the energy efficiency of HVAC through the following procedures (as listed in ESCWA 2003): checking and maintaining readings of control components such as room thermostats and air temperature controllers and verify setting of time clocks, establishing minimum and maximum temperatures for heating and cooling during occupied and unoccupied periods and readjust controls accordingly, adjusting airflow rates to suit changing occupancy conditions and use
of building space and prevent restrictions of airflows by checking or replacing air system filters, ensuring that vents are closed in winter and kept open in summer, shutting off exhaust and making-up air systems to areas when not in use such as kitchens and laundry.

The continuous maintenance of HVAC systems is essential to approach the energy efficiency, this can implemented through the following steps: (as quoted from ESCWA 2003)

- Maintain insulation on piping and duct systems to prevent energy loss.
- Maintain crushed or leaking ducts in the air system.
- Evaluate insulation levels in ceiling and add insulation as needed.
- Keep heat exchange surfaces, heating units and heating coils clean.
- Block unneeded windows.
- Use vinyl curtains or air blowers for loading dock doors to reduce the loss of conditioned air when shipping and/or receiving supplies.
- Maintain frequent cleaning and monitoring of water used for humidification to ensure efficient operations and avoid damage to other HVAC components.
- Evaluate equipment’s efficiency when installing/ replacing HVAC systems. Look for high efficiency ratings at least 10 EER/SEER and humidity capacity at least 30%.

The Sensor Stat turns off HVAC in unoccupied guest rooms
(Fedrizzi & Rogers 2002)
4.1.2 Lighting

Lighting seems to be more acceptable if compared to other devices using electrical devices, most of lights used in most hotels in Jordan are of energy saving type, though; some hotels are still using inefficient energy types of light bulbs inside guest rooms, after asking one of the employees in the Ministry of Tourism and Antiquities in the Research Department, it was found that it is not preferable to use neon lights in hotels since they are not strong enough. The field visits to classified hotels have shown that some five and four stars hotels are using dimmers to reduce the amount of electricity in the case of using regular types of lamps, whether in guest rooms or lobby areas (as in the case of Movenpick hotels).

When hotels in (D2/Task 1) were asked about their usage of natural light, the results show that 93.6% of hotels maximize its use of natural light. 90.0% of five star hotels and 87.0% of four star hotels maximize its use of natural light, while all of one star hotels do that.

More than half of the hotels (54.8%) mentioned that they are very willing to change incandescent bulbs to energy saving compact fluorescent light bulbs in their hotels to better protect the environment. Five star hotels were the highest hotels who expressed their willingness to change incandescent bulbs to energy saving compact fluorescent light bulbs (85.0%) while only 13.0% of one star hotels were willing to do so.

Improving the energy efficiency through lighting is a very common issue, and it has a great potential starting at the design stage by incorporating modern energy-efficient lamps and luminaires. Most of hotels in Jordan use efficient types of lights, regardless of their rating, the following photos show different types of them.
Lighting in a lobby area in a five star hotel in Jordan (although of using a non-saving energy type of lighting, dimmers are used to conserve energy)

Lighting in a guest room in a five star hotel in Jordan (although of being a non-saving energy type of lighting, dimmers are used to conserve energy)
One of the lights used in a 3-star hotel in Jordan (Corridor)

One of the lights used in a 3-star hotel in Jordan (Corridor)
One of the lights used in a 3-star hotel in Jordan (Front desk area)

The type of lighting used in most of four and lower rating hotels in Jordan

Some hidden neon lights are also used (Lobby and corridor areas)
One of the lights used in a 3-star hotel in Jordan (inside a guest room)
Lighting inside a conference room in a 4-star hotel in Jordan

Lighting inside a restroom in a 4-star hotel in Jordan (guest room toilet)
The use of daylight in a 4-star hotel lobby area in Jordan

13 and 18 watt lights used in a five stars hotel in Jordan
An energy saving type of lights used in a four stars hotel in Jordan (guest room)

Using of masterswitch (magnetic card) to save electricity only in apartments in a five star hotel in Jordan
Using Building Management System (BMS) to control the duration of work hours for machines in different departments in the hotel (a five star hotel in Jordan)
By installing new lighting technologies such as dimmers, photo sensors, occupancy sensors, and timers; it becomes possible to reduce both the amount of electricity and energy costs exploited in lighting. There are several types of lighting technologies that proved to be energy saving and affordable, the followings are some of them:

- Energy-efficient fluorescent lamps instead of "conventional" fluorescent lamps.
- Compact fluorescent lamps (CFLs) instead of incandescent lamps.
- Installation of high pressure sodium vapor (HPSV) lamps for applications where color rendering is not critical.
- Mercury vapor lamps should also be considered.
- LED exit signs instead of incandescents.
- Microprocessor-based controllers.
- Optimum usage of day-lighting in new designs.
- High frequency (HF) electronic ballasts instead of conventional ballasts.
- Occupancy sensors, an affordable way to guarantee that unneeded lights do not remain on.
- Photocells, devices that automatically detect the natural light level in a room, consequently the artificial light intensity will accordingly be adjusted.

- An automatic device, such as a key tag system, will improve housekeeping energy management. It will also help improving the load factor in the electrical system. Using a key-card system will make only occupied rooms consume energy; also most electrical appliances are switched off when the key-card is removed, this method is significant particularly when the guest does not stay for a long period of time in his room.

- Replacing incandescent wall lights and exit sign lighting with CFL or LED-lit units will save energy, and will save labor costs used to change light bulbs, that is due to the fact that CFLs and LEDs last much longer than incandescent bulbs.
A very important issue to consider is that lighting efficiency is related to saving energy in HVAC. When more energy-efficient lighting is installed, the sensible heat loads from the lighting are reduced, since compact fluorescent lamps produce less heat than equivalent-light-output incandescent lamps, this means less dependence on air conditioning to make room temperature less, and so saving more energy. The lighting and the HVAC system should be considered as linked operations (http://www.ase.org).

There are some guidelines that can be applied by hotel management to save energy consumed through lighting, also to reduce costs resulted from such operation, according to the report by (ESCWA 2003), and the following can be done:

- During design and construction phase:
  - Using occupation cards to disconnect air conditioning systems and lighting when guests exit the room.
  - Efficient lighting, in all areas as appropriate.
  - Maximum usage as possible of daylight (especially in lobby areas), this is related to designing windows and skylights.
  - Installing photocells that turn on and off in response to natural daylight.
  - Installing sheer curtains in guest room, these filter sunlight and consequently reduce need for electricity lighting.
  - Using occupancy sensors (motion detectors), such sensors switch on lights when movement is detected in the surrounding area and switch off when no motion is detected after 15 seconds.
  - Wall colors should not be ignored, some colors reflect daylight, such as white and cream colors, these reflect sunlight by 60 – 90%.

- Issues to be in mind by management and staff:
  - When replacing all old lamps in an institution area, the following should be considered:
    - Group re-lamping with new efficient models at once.
Using compact fluorescent lamps (without changing fittings) instead of tungsten lamps.

Fitting reflectors to fluorescent tubes, accordingly the number of tubes needed will be reduced by half.

- Fixtures, lamps and lenses should be cleaned every 6 months from dust and grease deposits.
- Substituting incandescent lamps in exit signs with compact fluorescent lamps. Such option will save energy by 50 – 75%, that is in addition to the fact that fluorescent lamps last 10 – 20 times longer.
- It is necessary to turn off lights when incandescent lights are not needed and when fluorescent lights will remain off for at least 15 minutes.
- Lights should be turned off in restaurants between serving meals and services areas (laundry, stores, and kitchens) between working hours.
- Using efficient lamps in areas where lights are expected to be needed for long hours.
- Installing dimmer switches that can reduce light intensity to 10 – 20% during the day, there can be used in hallways and lobbies where lights should be on 24 hrs.
- Discharging (HID) lamps for outdoor lighting.
- Cleaning fixtures more often when they are a part of HVAC systems.
- Establishing a regular cleaning program for windows and skylights, this will maintain light reflection to a constant dependable level.

- Guests can contribute to saving energy consumed in lighting by turning off lights, TV and other electronics when leaving the room; and making use of natural light as much as possible.
Using nitrogen gas (ammonia) in mini bars instead of electricity (five star hotel in Jordan)
4.1.3 Heating Water

Unfortunately most of hotels in Jordan use fuels in the first place, and electrical energy in few cases to heat water. According to the filed visits, some managers are willing to and planning to use solar power to conserve energy. Though, some managers said that this kind of water heating is not sufficient, especially in the case of big number of rooms.

Most medium-to-large hotels use boilers to generate hot water or steam for space heating, water heating, and laundry services. For boilers to run at peak efficiency, operators find it necessary to use methods as boiler staging, water chemistry, pumping and boiler controls, fuel air mixtures, burn-to-load ratios, and stack temperatures. Another method to implement is insulation, which can be applied to valves, condensate receiver tanks, and various parts of the boilers. Keeping boiler systems at peak efficiency is important as well, since it will reduce operating costs and environmental impacts. (http://www.ase.org)

Energy efficiency can be obtained in water heating through the following guidelines (listed in ESCWA 2003) by different groups involved in such operation including investors and management:

- Procedures to be taken by investors:
  
  ✓ Insulating hot water storage tanks and piping to reduce heat loss.
  
  ✓ Evaluating the use of decentralized small water heaters to reduce the peak load of the main water heating system or that of the electric generators, which supply electricity for heating water.
  
  ✓ Evaluating and installing as appropriate waste heat recovery systems on large generating units, laundry, etc.
  
  ✓ As appropriate, solar water heating systems should be installed for guest rooms, swimming pools, and other services equipment.

- For management and staff, the following should be done:
  
  ✓ Setting water heaters thermostats at not more than 50 -55 °C, for guest room water.
✓ Using a booster heater for higher water temperatures for dishwaters and laundry equipment use.

✓ Minimizing temperature of water used for cleaning utensils (without reducing the temperature below the permissible level).

✓ Adopting a regular boiler tuning program

✓ Adjusting fuel / air ratio to maintain higher efficiencies.

✓ Checking toilets, faucets and showerheads for water leaks and repair immediately.

✓ Using low-flow shower-heads (2 ½ to 3 gallons per minute are recommended)

✓ Checking and maintaining gas boilers and water heaters twice a year to reduce scales and increase efficiency.

✓ Replacing inefficient water heating systems.

✓ Considering water treatment to prevent scaling.

A heat pump water heater provides free cooling while heating water

(Fedrizzi & Rogers 2002)
4.2 Proposal 2: Water Management

Unfortunately, some hotels in Jordan are still not using water saving aerators or showerheads, not even low-flow toilets. Mostly, five and four star hotels are the ones using these techniques. After a number of field visits, it was found that some managers are not using water aerators for tabs or showerheads because of the cost, and some said that such devices caused some damage (?). Regarding low-flush toilets, even if these are not used, weights are used inside water containers to reduce the amount of water used.

Another serious matter is the non-use of any water treatment by some hotels, so that water can be reused, in the case of Aqaba and Dead Sea Movenpick hotels, water treatment plants are used, which is not the case in Petra's Movenpick and most of hotels in Jordan, managers of Movenpick hotel and Crown Plaza hotel in Petra say that they used to have a treatment plant, of which water was used for irrigation only, but after the construction of the central treatment plant of Petra few years ago, they stopped using them. Some five star hotels though installed systems to separate wastewater from kitchen and laundry from that coming from guest rooms.

The results of (D2/Task 1) show that five, four and three star hotels apply water conservation practices in their hotel (90.0%, 79.2% & 96.4%, respectively. However, 73.6% of one star hotels and 62.3% of the two star hotels apply conservation practices in their hotels. In general 77.4% of hotels apply water conservation practices.

The results state that 6.7% of hotels said that they already using discharged water from washing machines to flush toilets in their hotels. While 54.7% of all hotels said that they are "not very willing and not at all willing" to use discharged water from washing machines to flush toilets in your hotel to better protect the environment.

About 33.6% of all hotels have water treatment system in the hotel, 81.0% of five star hotels, and 70.8% of four star hotel while 13.0% of one star hotel

The results show that 36.4% of all hotels are very willing to use aerators on water outlets in their hotels to better protect the environment. Moreover, 70.0% of five
star hotels are very willing to do so, 48.0% of four star hotels, 28.6% of three star hotels, 25.9% of two star and 37.1% of one star hotels.

Water conservation practices were among other parameters that appeared to have an importance among hotels in general. The results show that 52.7% of hotels have low-flow showerheads in guestrooms. 61.9% of five star hotels and 62.5% of four star hotels do have low-flow showerheads in guestrooms. Moreover, the results show that 68.5% of hotels have Low-flow sink aerators in guestrooms. 66.7% of five star hotels and 69.6% of four star hotels do have Low-flow sink aerators in guestrooms. Also, 68.8% of hotels have a water usage plan with specific savings goals. 81.0% of five star hotels and 91.3% of four star hotels do have a water usage plan with specific savings goals, while 47.2% of two star hotels do have it.

Guest showers, pools, and especially laundry operations account for a considerable share in the hotel consumption of water. Water use in hotels varies depending on geographical location, occupancy, property type and season of the year. The average water use is 218 gallons per occupied room per day. Larger properties use more water due to the water intensive facilities often found in the larger hotels, i.e., pools, laundries and restaurants.

Excessive use of water increases the cost of operation, increases electrical energy required for pumps, depletes the water supply and puts extra demands on waste water disposal plants. (Hammer & Townsend 1993)

Since saving water and costs of its consumption is highly demanded, several technologies were developed to achieve such goal. Such technologies for example include:

- **Ultra Low-Flow Toilets:** The idea behind using such kind of toilets is to reduce the water used per flush, typical toilets used between 19 and 26 liters (5-7 gal) per flush, while ultra low-flow toilets uses as little as 3 liters (0.8 gal) per flush.

- **Toilet Dams or Other Water Displacement Devices:** Such tool is also based on using less water at each flush; such devices block part of the tank
so that less water is required to fill the toilet following each flush. This can be also obtained by using a plastic bottle filled with water to limit the tank’s capacity. Although problems may occur with the need to double flush, water savings from these devices are estimated at about 10 percent.

✓ **Low-Flow Showerheads**: Low-flow shower heads use less than 9.5 liters (2.5 gal) per minute, which is efficient if compared to typical showerheads that use about 17 to 30 liters (4.5-8 gal) per minute, with no marked reduction in quality or service.

✓ **Efficient Faucet Aerators**: These devices can easily be installed on the ends of most faucet systems, such devices allow less water to flow through the faucet, and most consumers will not notice a difference. These devices can save between 12 and 65 liters (3.2-17.2 gal) per day.

✓ **Landscape Water**: The following techniques are the most effective ways to control outdoor water use:

- Keeping only native, drought-tolerant plants that can thrive with minimal water on a property (Xeriscaping plants).
- Moisture sensors in soils.
- Controllers on irrigation systems. (http://www.ase.org)
An aerator and a showerhead in a 4-star hotel in Jordan
A low-flush toilet in a 4-star hotel in Jordan

A water saving tab in a 4-star hotel in Jordan
Control water devices insulted for beach showers in a five star hotel in Aqaba

Using drip irrigation system to save water in a five star hotel in Jordan
4.3 Proposal 3: Solid Waste Management

Unfortunately, there is a low commitment of hotels in this regard. More than 88 percent of all hotels do not adopt a recycling program in their hotels. 47.6% of five star hotels adopt a recycling program, 12.5% of the four star hotels while there is no recycling program adopted at one star hotels (according to D2/Task 1 results).

Some five and four stars hotels use reusable items such as cloth napkins, glass cups, ceramic dishes, etc. with all food and beverage services. They also provide glass cups and ceramic mugs (instead of plastic) for in-room beverages, also place cups and mugs upside down on paper doilies (instead of covering opening with a plastic wrapping).

The best solution in this case would be following a serious recycling program, in addition to sorting rubbish or solid waste in clearly marked containers, a procedure that will help both guests and staff in this process. Such containers will be separating solid waste according to the following categories:

1. Paper
2. Glass
3. Metal (Mainly cans)
4. Plastic (Mainly boxes and detergents containers)
5. Biological waste and composting
6. Energy saving lamps
7. Batteries
8. Special containers for old oil, toxic waste

All these should be then put in kitchen and in hotel disposal site with some specific circumstances to avoid any changes that might happen to the material in the containers.

This should be then followed by putting and enforcing regulations and standards when inspecting hotels by the ministry of tourism and other concerned authorities. Another basic step is contracting a number of waste disposal companies for toxic waste; these will be responsible and able to dispose such kind of waste properly.
Another procedure is recycling with help of private contractors or local authorities for other kinds of waste.

Some other small scale procedures can make a difference, such as the avoidance of using single portion packages used in kitchens and for detergents.
4.4 Proposal 4: Awareness of Staff and Guests

There is a lack of training for the staff regarding the use of energy, all the concentration is given for the quality of services given to the guest. Some of the hotels though try to increase the awareness among the guests regarding the consumption of water and electricity or washing towels.

According to (D2/Task 1), the results show that 44.1% of all hotels provide guests with information to save energy while staying in the hotel. 55.0% of the five star, 37.5% of four star, and 62.3% of one star hotels provide guests with information to save energy while staying in the hotel. And 41.1% of all hotels promote "to a great extent" turning the lights off whenever they are not needed. 62.3% of one star hotels, 41.1% of three star, 39.1% of four star, 27.3% of five star and 20.4% of two star hotels promote "to a great extent" turning the lights off whenever they are not needed.

Most of the hotels believe that their guests are to great and moderate extent concerned about the environment. And that 9.9% of all hotels use a renewable energy sources while 59.0% depend on fossil fuel sources and 30.6% use both sources. 75.0% of five star hotels depend on fossil fuel sources and 5.0% on renewable sources. Also, the results show that 71.7% of all hotels apply any energy conservation practices in their hotel while 95.2% of five star hotels apply such practices, 87.5% of four star hotels, and 62.3% of one star hotels. More than 59 percent of all hotels installed equipments to reduce energy consumption for heating, ventilation, air-conditioning in their hotel while 79.2% of four star hotels installed such equipments, 71.4% of three star hotels, and 55.3% of five star hotels.

The results show that 33.6% of all hotels have water treatment system in the hotel. 81.0% of five star hotels, and 70.8% of four star hotel while 13.0% of one star hotel.

In addition to the tasks mentioned previously about the role of management in using and maintaining different tools and systems in hotels, education and training are essential parts of the energy management program, they are considered as an
efficient and cost-effective way to reduce energy use in tourist facilities, such approach is based on involving personnel.

The results of (D 2/Task 1) show that 95.2% of the five star hotels are willing to great extent to undertake a comprehensive environmental program in their hotel; 82.6% of the four star hotels; 83.9% of the three star hotels; 52.8% of the two star hotels; and 49.3% of the one star hotels.

Employing environmental officer is an important indicator among others to show the level of concern of the hotels toward protecting the environment. The results show that 86.0% of all hotels do not employ an environmental officer in their hotels. 61.9% of five star hotels do employ an environmental officer, 21.7% of the four star hotels while none in one star hotels.

The results show that 44.1% of all hotels provide guests with information to save energy while staying in the hotel. 55.0% of the five star, 37.5% of four star, and 62.3% of one star hotels provide guests with information to save energy while staying in the hotel. Also, 41.1% of all hotels promote "to a great extent" turning the lights off whenever they are not needed. 62.3% of one star hotels, 41.1% of three star, 39.1% of four star, 27.3% of five star and 20.4% of two star hotels promote "to a great extent" turning the lights off whenever they are not needed. Most of the hotels believe that their guests are to a great and a moderate extent concerned about the environment.

Facility employees, manager and guests; all should be participating in awareness programs. This is done through informing the employees, training of hotel staff and personnel is a key issue in operation and maintenance stage. Benefits from personnel involvement are based on two issues: motivation and information.

For the information part, informing personnel about how to save energy and how much can be saved will make them more enthusiastic to take a part. Informing personnel can be achieved through the staff meetings, flyers and bulletin boards as well as other interpretation methods as appropriate. More can be achieved through participating in simple activities, which aim at giving awareness about the importance of regulating energy consumption; this can be reinforced by giving
prizes for competitions, done for this purpose between the different administrations in the facility.

Motivation comes then through giving a sufficient and a clear feedback. Information about such progress achieved in upgrading energy efficiency can be spread by leaflets or newsletters showing how much energy was used in each facility section compared to earlier periods. These will create a competition between different sections of the hotel, or for hotel chains.

It is also important and effective to involve the facility guests and inform them of the energy management program being implemented, this can be done by carrying out simple action that are presented in posters and flyers available throughout the facility, also brochures regarding positive behaviors to be taken, also efforts done already by the hotel. The awareness level of the guests about the vitality of energy efficiency and sustaining the environment is a basic issue that should be considered as well.
Chemicals stored safely in a well-ventilated area with warning sign in a five star hotel in Jordan
A sign of awareness regarding the conservation of electricity in a five star hotel in Jordan (a staff room)
A sign of awareness regarding the conservation of electricity in a three star hotel in Jordan (a guest room)

A sign of awareness regarding the conservation of water in a three star hotel in Jordan (a guest room)
A sign of awareness regarding the washing of towels and sheets in a 4-star hotel in Jordan
A sign of awareness regarding the washing of towels and sheets and sheets in a 5-star hotel in Jordan
Back to the role of the staff in energy efficiency, the following procedures can be done:

- Front office personnel
When assigning rooms, it should be guaranteed that guests are assigned to adjoining rooms, so that the heating or cooling of occupied rooms act as a buffer or insulator.

- Housekeeping
Well-informed housekeepers can contribute to saving energy through some procedures, such as turning off heating and cooling, televisions, closing draperies/shades systems in vacant rooms, limiting the amount of hot water used for cleaning, reporting needed equipment repair (e.g., leaking faucet, malfunctioning air conditioner).

- Public areas and services
Public as lobby, meeting rooms, offices, shops, bars and lounges can contribute to efficiency since their energy consumption control is much easier. For example, scheduling meeting functions in rooms that are served by the same space conditioning system; assigning an individual to be responsible for turning the heating and cooling system on or off according to a daily time-of-use schedule for the various function rooms.

Some public areas, such as lobbies and hallways, may require lighting 24 hours a day. Replacing incandescent lighting, with efficient fluorescent lighting can substantially reduce the cost of lighting.

Swimming pools and spas: energy efficiency can be achieved through following manufacturer's preventive maintenance program, installing timers on pool and spa heaters, operating spa and pool heaters only during times of usage, allowing for a short warm-up time just before use, keeping pool thermostats at 80-82 degrees or lower, and spa thermostats at 95-100 degrees, and to consider sheltering outdoor pools and spas from prevailing winds with hedges, fencing or other windbreaks. (ESCWA 2003)
In addition to the previously mentioned procedures to save energy, there are some more tips that can be considered: (these are quoted from: http://www.orhma.com)

- Install low-wattage bathroom and foyer night lights to discourage guests from leaving on less-efficient lights.
- Schedule machine operations at off-peak periods to reduce possible demand change.
- Discourage housekeepers from turning on televisions while cleaning. Once a room has been made up, all lights and appliances should be turned off and thermostats set to minimum.
- In the case of refrigerators and Freezers, ensure doors fit and close properly. Maintain door gaskets and seals in good condition. Insert a piece of paper between door and its frame – if the paper can be withdrawn easily, then the gasket is not sealing properly.
- Keep lights off in service areas- including storage rooms, employee lounges, housekeeping closets and walk-in refrigerators – when closed or occupied. Turning lights off even for a few minutes at a time will save energy over the long run.
- Ensure that all vents, including return air vents, are unobstructed by items such as boxes, curtains and displays. Blocking airflow reduces the efficiency of HVAC systems and increases energy costs.
- Make sure a qualified technician regularly maintains your HVAC equipment. Ensure cooling towers are serviced regularly since they are subject to scale deposits, clogged nozzles, poor airflow and poor pump performance.
- Install a weatherboard in your housekeeping area to remind employees how to set guest room cooling-and-heating equipment. Post color-coded guides based on daily weather forecasts. These guides should include the day's temperature, appropriate thermostat settings and fan-switch positions.
- Defrost freezers frequently since frost buildups reduce efficiency. Install a thermometer in each freezer to enable frequent temperature checks. Defrost and re-cool during off-peak hours.
The boiler is one of the most energy-intensive and inefficient appliances in the kitchen. Preheat no longer than manufacturers' instructions recommend, and only heat as many sections as required by cooking load.

A toilet that runs between flushes can waste about 750 liters (200 gallons) per day. Encourage housekeepers to report leaks promptly. To test toilets, place dye or food coloring in the tank and check the bowl for color after 15 minutes.

Avoid simultaneous heating and cooling, which often occurs when daily temperature fluctuations can lead to the activation of both systems. Remember to reset time switches for daylight-saving time.

Limit the general use hot water tank to 43C except where sanitation is required such as dishwashers. If the faucet water is too hot, users will add cold water which increases both water and energy use. Turn down gas water heaters to 24C when closing kitchens and laundries. Turn back up 2 hours before opening.

Ensure refrigerator compressor belts maintain proper tension. Replace damaged and worn belts promptly. Regularly inspect compressor lines since the presence of frost may indicate a breakdown in insulation. Ensure freezer curtains remain in a vertical position to retain cool air and keep pou warm air.

Swimming Pools: Backwash filters only when pressure loss through filters reaches the prescribed or recommended values indicated in manufacturers' instructions. Check pool temperatures regularly to ensure heater thermostats are working properly. Pool temperatures should not exceed 27 degrees Celsius.

Fryers: Turn thermostats only as high as necessary to reach frying temperatures. Temperatures ranging from 325F (163C) to 350F (177C) are ideal in modern high-speed fryers. If temperatures are too high, oil will break down. Regularly check the temperatures of cooking oil with a reliable commercial thermometer to ensure heating elements and thermostat controls work properly.
✓ Summer: Reverse the operation of heat recovery equipment to reduce energy consumed by air-conditioning systems.

✓ HVAC: Avoid placing televisions, computers, lamps and hair dryers near thermostats. The heat from these and other appliances or equipment may affect thermostat readings and lead to increased energy consumption for cooling.

✓ Fall: Avoid simultaneous heating and cooling, which often occurs when daily temperature fluctuations can lead to the activation of both systems.

✓ Compressed-Air Systems: Monitor both use and pressure requirements. Every pressure reduction of 0.14 kilograms per square centimeter (two pounds per square inch) reduces total system horsepower by 1 percent.

✓ HVAC: Remove obstructions that restrict the free flow of air through heating and cooling units. Make sure air supply or return grilles are not blocked by furniture, books or magazines, which waste energy by making the air-handling units operate longer than necessary. If pipe insulation is removed or damaged after maintenance, ensure it is replaced promptly or consider removable insulation.

✓ Hotel Tips: Check for worn and cracked caulking and weather-stripping on doors and windows of all rooms, including those that have been permanently closed.

✓ Lighting: Make sure lighting controllers (time clocks and photocells) are well maintained and properly set. Check to ensure exterior lighting is off during the day.

✓ Insulation: Seal air leaks and cracks with foam, caulking and weather-stripping. Use fiberglass or glazier's foam backer rod insulation in areas too large to be caulked.

✓ Check gas burners periodically. If flames are yellow or uneven, clean burner with wire brush and make sure holes are unobstructed. Regularly inspect safety controls and automatic lighters. Check thermostats for accuracy and recalibrate, if necessary.
Flush boilers at least once each week, following manufacturers’ instructions. Use commercial strength cleaning chemicals occasionally, especially if water is hard.

Reduce thermostat settings in winter and raise them in summer when preparing and cleaning meeting rooms. Reduce lighting levels as well. Shut off heating, cooling and lighting when rooms are not in use.

Examine your buildings external envelope for damage that could result in heat loss or gain.

Check heating-system controls to ensure they respond to weather changes. Minimize heating-energy consumption by setting temperatures at cool but comfortable levels.

Avoid simultaneous heating and cooling, which often occurs when daily temperature fluctuations can lead to the activation of both systems.

Adjust heating systems to ensure that they are comfortable, but not too warm (recommended: 20°C or 68°F).

Turn off heating earlier in the day, and ensure your building's warm-up period is shorter than in winter.

Broilers: Rearrange ceramic material in under-fired broilers once a month to ensure even heat. Check ceramic and metal surfaces for deterioration. Replace when blackened or cracked.

Summer: Check all external doors to ensure that they close and fit properly, and that automatic door-closing mechanisms are working efficiently. Ensure all windows fit and close properly. Repair damaged handles and catches.

Summer: When buildings are closed for extended periods, ensure all non-essential HVAC and lighting systems are switched off.

Water: Monitor water use in landscaping operations to minimize waste. Encourage housekeeping staff to tighten all faucets and report dripping faucets promptly.

General Kitchen: Establish and periodically review start-up and shut-down schedules for all major kitchen equipment, especially air-deck ovens.

Hotel Guest Rooms: Place tent cards and decals in guest rooms to offer specific energy efficiency suggestions for guests.
✓ Break the habit of turning everything on first in the morning. Leave equipment off until it is needed and turn it off when it is no longer needed.

✓ Adjust heating systems to ensure temperatures are comfortable, but not too cool (recommended: 20 C or 68 F). Check the reset timers at the end of daylight-savings time.

✓ Set documented lighting shut-off procedures for closing and make an on-duty staff person responsible. Switch energy-intensive lights off as soon as the restaurant closes. Add a Last Person Out switch.

✓ Use task lighting whenever possible. Carefully focus directional and spot lighting to minimize the amount of spill light.

✓ Check heating-system controls to ensure they respond to weather changes. Minimize heating-energy consumption by setting temperatures at cool but comfortable levels.

✓ Dishwashers: Add extra insulation to reduce standing heat loss in water heaters and storage tanks. Do not over-dry dishes. Adjust power dryers to deliver heated air just long enough to dry dishes.

✓ Activate heating not according to the calendar, but only when required to offset cold temperatures.

✓ Hotel Tips - Open drapes and shades to take advantage of natural light when servicing rooms.

✓ Insulation: Watch for wet insulation and replace it immediately once the source of the moisture has been identified and repaired.

✓ Compressed Air Systems: Check filters and drain traps, and watch for pressure drops as part of regular maintenance
4.5 Proposal 5: Landscape Surrounding the Hotels

One of the main problems facing hotels in Jordan, and mainly the three, two, and one star hotel is the neglect of areas surrounding hotels. Usually such areas are used for dumping old furniture and material used in hotels. Such problem requires then legal and enforced restrictions regarding their usage and image. Such restrictions should concentrate on creating green areas, playing ground, or even specific places for recycling bins. Another convenient usage is using them for boilers and machines used for heating and energy supplications, which will help in avoiding the problem of noise caused by these machines.

The area between a three star hotel and a two star hotel in the site of Petra

Another important issue is the lack of environmental assessment, especially in the stage of constructing the hotels, during the field visits, non of the managers did have any idea if any assessment of this kind was done, most of them said probably not, which is an issue to be considered. This issue is serious in some areas, such as Petra site, where hotels where constructed in an area close to the archaeological site, which is also is a water catchment area.
5 Sub Metering and Monitoring

Energy monitoring is a management technique that focuses on any variables related to energy (fuel, steam, refrigeration, compressed air, water, and electricity), which are collected through control systems as a basis to eliminate waste, reduce and control current level of energy use, and improve existing operating procedures. This will consequently help in finding appropriate management implications to solve any energy inefficiency. Monitoring can be obtained through the following stages:

- **Recording** - Measuring and recording of different forms of energy consumption.
- **Analyzing** - Correlating and relating energy consumption to a measured output, such as occupancy, and so to know the factors behind consuming some particular amounts of energy.
- **Comparing** - Comparing energy consumption to a specific standard or benchmark.
- **Setting Targets** - Setting targets to reduce or control energy consumption.
- **Monitoring** - Comparing energy consumption to the set target on a regular basis.
- **Reporting** - Reporting the results, and comparing all variances from the targeted standard values or standards.
- **Controlling** - Implementing management procedures to correct any variances which reflect any deficiency.

Sub metering is measuring and collecting a detailed energy-use data for one or more departments in a facility. Sub metering can be done with simple handheld instruments, complex data loggers, or as part of a state-of-the-art control system. Data from sub metering can result in a 1-2 percent reduction in energy use simply through increased awareness and accountability. Such method identifies energy waste and equipment operating out of control; it also allows management to allocate energy costs to departments based on actual use, helps to evaluate performance and identify problems, it also makes it easier to identify energy-saving
measures and quantify benefits, and most of all it can be implemented at various scales and levels of process integration.

(http://www.ase.org)

But even if we think about these two methods, there is a problem is facing hotels, and that is not having a uniform definition of area to be used in calculations or measuring monitoring variables. Most hotels are familiar with the area of their guestroom and the banquet rooms as they use these for marketing purposes. Most hotels that report their energy consumption to a central body should be reporting with reference to their area so that comparisons between hotels, and not just with last year, this will initiate then the need to develop an area definition that can be used universally. (Commonwealth of Australia 2002)
6 Some Other Problems Faced by Hotels in Jordan

There are some other problems faced by hotels in Jordan, these were recorded after field visits to a number of hotels. These can be listed as:

- Using regular washing machines (no energy conserving models)
- No detailed information is provided about energy saving appliances and monitoring systems.
- Water from swimming pools is sent back to the sea in the case of some Aqaba hotels.
- Separation of kitchen oil in septic tank is done in some hotels; however, the oil is taken by the wastewater tank collector and is dumped in local domestic wastewater treatment plants.
- No guestroom recycler baskets for newspaper, white paper, glass, aluminum, cardboard, and plastic.
- No recycling bins whether in public areas (i.e., poolside), in the kitchen, and in the back office (including one at each desk) to make recycling as easy as possible.
- No linen (both towels and sheets) reuse program in all hotels' guest rooms.
- No refillable hair and skin care dispensers used for guest amenities.
- No training courses in all hotels are offered to staff regarding environmental issues like: turn off lights and turn down heating/air conditioning when rooms are unoccupied. Also, during summer months, to close the drapes.
- No window film installed to lower heating and cooling loads and reduce glare in guestrooms.
- No office and guest amenity products that contain recycled material.
- No recycled paper products used (with high post-consumer recycled content), those are either unbleached or bleached using a chlorine-free process.
- The use of regular toxic cleaners, sanitizers, paints, pesticides, etc. throughout the hotel. However all chemicals are stored safely in a well-ventilated area in many hotels.
Many hotels have pools, but with no pool covers when the pool area is closed.

Information about public transportation is not available for guests, and no bicycles are provided to guests.

Not planting an organic garden in hotels areas to provide fresh products for guests.

No minimizing of the amount of paper used for each guest (i.e., reduce paper size of invoices, etc.).

No professional association which provides information and recognition to their elite corps of green hoteliers.

No guidelines and Ideas", booklet containing a large amount of smart conservation ideas and techniques.

All cleaning products and all toxics are not sent to appropriate disposal landfills.

Using bleach and ammonia products for laundry in most hotels.
7 References


