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A GUIDE TO EFFICIENT ENERGY MANAGEMENT IN THE TOURISM SECTOR

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INTRODUCTION

A. BACKGROUND

The tourism industry worldwide has been growing very rapidly over the last decades to become amongst the most prominent global economic sectors. In 2002, the tourism industry has generated directly around US$ 462 billion in economic activities [(1)] and tourism sector economy employed over 207 million people in 2001 (direct and indirect).[(2)] In ESCWA member countries (MCs), more emphasis is placed on promoting tourism and realizing its importance in having diversified national economies. As a result, the tourism sector in the region is rapidly developing, to become a prominent economic sector, and its receipts have increased very significantly over the last decade in most member countries.[(2)]

In spite of the above, the rapid growth of the tourism industry, particularly in coastal areas, can place a heavy burden on broad range of natural resources, cultural heritage and on both local and global environments, which in turn can affect the economic health of the tourist facilities. Meanwhile, a significant challenge to planners, engineers and architects in the development of tourism facilities is the decisions made regarding the design of systems, for services such as energy and water supplies as well as wastewater treatment. The design of such systems can play a pivotal role in the success or failure of the tourist village and therefore deserve special attention by the developer at the very outset of the tourist village development project.[(3)]

It is due to the above that, Article 41, of the Johannesburg Plan of Implementation (JPOI), endorsed by the World Summit on Sustainable Development (WSSD), has called for adopting measures for promoting sustainable tourism development, including non-consumptive and eco-tourism, taking into account the spirit of the International Year of Eco-tourism 2002 and the "Global Code of Ethics for Tourism", which includes a set of general principles necessary for accomplishing sustainable and responsible tourism development. Accordingly, the JPOI called for actions at all levels including: (1) To develop education and training programmes, that encourage people to participate in eco-tourism, in order to improve the protection of the environment, natural resources and cultural heritage; and (2) To provide technical assistance to countries to support sustainable tourism business development, investment, capacity building and tourism awareness programmes.[(4)]

Since energy systems are an integral element of the design, construction and operation of all kinds of tourist facilities, the appropriate design and management of energy systems, particularly for efficient energy use, emissions and pollution reduction, and effective management of local resources, are of prime importance in promoting sustainable tourism development. In addition, systems that are designed, installed, or operated improperly can ruin the area's major tourist attraction: the environment. When the cost of energy and the potentially devastating environmental impact of an ill-planned tourist facility are added to the picture, the need for sound guidance on planning, designing, constructing, and operating such facilities becomes clear.

It is due to the above described needs for promoting the awareness of planners, developers, designers and operators of tourist facilities on issues relevant to sustainable tourism development, and in line with its efforts to promote more sustainable energy production and consumption patterns, that ESCWA has included in its (2002-2003) work programme on Energy an activity on "A Guide to Efficient Energy Management in the Tourism Sector". This activity responds to the above described needs of the tourism sector and completes the series of studies published by ESCWA in 2001, on efficient use of energy in the different economic sectors, namely: the building sector,[(5)] the industrial sector,[(6)] as well as the transport and the electric power sectors [(7,8)] .

B. OBJECTIVES AND CONTENT

The primary objectives of this guide is to help public and private sector planners and developers, as well as the management and operating staff, in the tourism sector in ESCWA MCs, to: (1) understand the interrelationships among the major systems required for a successful sustainable development of tourist facilities "hotels and tourist villages" with focus on the required energy systems, and (2) to conceptualize and recommend options for energy systems, design and management, that minimizes the consumption of scarce energy resources and reduce the energy systems environmental impacts. However, the intent of this guide is not to steer the developer to a specific design or technology options, but rather to provide an understanding of the overall significance of the planning, design and management decisions that can be made. The guide is presented hereinafter in five chapters:

Chapter I: Provides a brief background information on the rational for promoting Sustainable Tourism Development (STD), an overview of the STD concepts, goals, priorities and measures that have been adopted by global conferences and concerned international organizations. It also discusses the energy relevance to STD and present some of the initiatives developed on the subject.

Chapter II: Presents a brief description and analyzes the different energy supply options for tourist facilities indicating their suitability for different energy usage in the sector. It also discusses the typical loads energy consumption profiles for different energy applications together with the impacts of the operating conditions on such patterns.

Chapter III: This chapter conceptualizes and recommends options for energy systems, design and management that minimizes the consumption of scarce energy resources and reduce the energy systems environmental impacts. It recommends a design strategy and approach for energy systems, within the overall planning and design phase of the tourist facility as well as a set of design options and guidelines that can improve energy management and upgrade the energy production and use efficiency in the tourist facilities.

Chapter IV: Reflects the nature of the tourism development in the region and the efforts directing towards improving energy management in it, this chapter presents two experiences from within two member countries: Egypt and Lebanon.

Chapter V: Presents outlined conclusion of the outcome of the previous chapters of this guide and includes a set of five guidelines sections on: (1) the energy systems design strategy and systems approach; (2) energy efficiency in heating, ventilation and air conditioning; (3) energy efficiency in lighting; (4) energy efficiency in water heating; and finally (5) energy efficiency in kitchen and laundry services.

ABBREVIATIONS

BTU	British thermal units
CAST	Caribbean Alliance for Sustainable Tourism
DC's	developing countries
EMCS	energy management and control systems
EMS	energy management systems
EPA	Environmental Protection Agency
ESCWA	Economic and Social Commission of Western Asia
EU	European Union
GDP	gross domestic product
HVAC	heating, ventilation and air conditioning
HVS	heating and ventilation systems
IYE	international year of eco-tourism
JPOI	Johannesburg plan of implementation
kW	kilowatt
kWh	kilowatt-hour
LCECP	Lebanese Center for Energy Conservation and Planning
LDC's	least development countries
LE	Egyptian pound
m^2	meter square
MC's	member countries
MEW	Ministry of Energy and Water
MOE	Ministry of Environment
MVA	mega volt-ampere
NG	natural gas
NGO	non governmental organization
NREA	New and Renewable Energy Authority
O & M	operation and maintenance
STD	sustainable tourism development
SWH	solar water heating
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
USAID	United States Agency for International Development
WSSD	World Summit on Sustainable Development
WTO	World Tourism Organization
WTTC	World Travel and Tourism Council

I. SUSTAINABLE TOURISM DEVELOPMENT

The tourism industry plays an important role in the development process of both developed and developing countries. For many countries, tourism is well established as one of the most significant and fastest growing economic sectors, creating foreign exchange earnings, job opportunities, enormous infrastructure investments, as well as being a source of substantial tax revenues for governments.

The economic health of tourist facilities, particularly in coastal areas, depends largely on maintaining the quality of its primary resource: the environment. However the tourism industry has a broad range of impacts on the environment, depending on the type of tourist facility, site specifics and systems used. The sector is a large consumer of natural resources, mainly land, water, and energy resources as well as food, and other commodities.

An industry with such potential and impacts is worth maintaining and enhancing, within the framework of sustainable development. Accordingly, concerted efforts have been devoted by countries and concerned international organizations to streamline actions towards achieving more sustainable tourism development through maximizing the positive impacts of tourism, while minimizing its associated negative impacts on environment and societies.

This chapter provides brief background information on the rational for promoting Sustainable Tourism Development "STD", an overview of STD concepts, goals, priorities and measures that have been adopted by the concerned international organizations and global conferences. It also discusses the energy relevance to STD and present some of the initiatives developed on the subject.

A. BACKGROUND

The tourism sector has been developed very rapidly during the last decades, with remarkable far-reacting impacts of a social, economic and environmental nature in countries and worldwide. Accordingly the sector has crucial impacts for achieving the three pillars of sustainable development and should itself be managed in a sustainable way. This part spotlights the sector's role in the world economy, its development in the ESCWA countries as well as its environmental impacts.

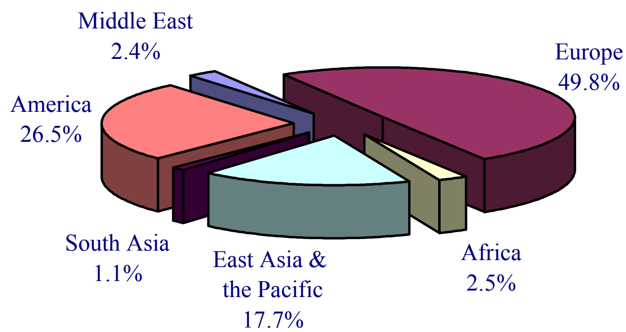
1. Tourism in the world economy

During the last decade the tourism industry has become one of the largest businesses in the world economy and an important source of foreign currency and employment, in the world today, both in developed and developing countries. They do this via four major activities, profits earned and distributed to owners, taxes paid on sales, wages and real estate, jobs created; and purchase of supplies. Tourism returns in the world have reached approximately 462 billion dollars in the year 2001 with an average of 1.3 billion dollars/day, despite the decline of 2.6 percent in those returns after the incident of September 11 in the United States of America [(2)].

The tourism returns are highly contributing to the total services sector returns in different country groups, reaching 28.6 percent in the European Union (EU) countries, 43.3 percent in Developing Countries (DCs) and 70.6 percent for the Least Developed Countries (LDCs), which reflects the important role of the tourism sector for the economies of DCs and LDCs. The distribution of the tourism returns by the different regions of the world is shown in Figure I, where Europe comes first followed by the United States of America (USA), East Asia and the Caribbean. Table 1 shows tourisms most receiving countries throughout the world, nine of the European countries which hold around 50% of those returns are included in the list of the top fifteen tourists most-receiving countries in the world, with France, Spain and Italy occupying the top three ranks in the list respectively. Meanwhile, an added value is that the tourism services represent an important percentage of the commodity exports list in the world, they represent 8.5% of the developing countries' exports and around 11.3% of the least developed countries' exports [(1)].

Tourism returns indicate that the sector is qualified to play an effective role in eradicating poverty in developing and least developed countries. The support of this sector would increase the returns generated from foreign currency acquisition and related new investments and associated creation of new job opportunities. This would most likely support the economic growth and thus help reduce the debts that represent a major problem for most developing countries [1].

Figure I. Distribution of tourism returns by world geographic regions



Source: World Tourism Organization (WTO), 2002, "Tourism Proves as a Resilient and Stable Economic Sector". Website: www.world-tourism.org

TABLE 1. TOURISTS MOST- RECEIVING COUNTRIES IN THE WORLD

Rank	Country	Tourists number (million)		Growth rate (%)
		2000	2001	
1	France	75.6	76.5	1.2
2	Spain	47.9	49.5	3.4
3	United States of America	50.9	45.5	-10.6
4	Italy	41.2	39.0	-5.3
5	China	31.2	33.2	6.2
6	United Kingdom	25.2	23.4	-7.4
7	Russia	21.2	-	-
8	Mexico	20.6	19.8	-4
9	Canada	19.7	19.7	-0.1
10	Austria	18.0	18.2	1.1
11	Germany	19.0	17.9	-5.9
12	Hungary	15.6	15.3	-1.5
13	Poland	17.4	15.0	-13.8
14	Hong Kong (China)	13.1	13.7	5.1
15	Greece	13.1	-	-

Source: World Tourism Organization (WTO), 2002, "Tourism Proves as a Resilient and Stable Economic Sector". Website: www.world-tourism.org

As a labor-intensive industry, hospitality employs large numbers of wage earners, whose taxes and income add to gross domestic output and help to create further employment opportunities. Typically each hotel room requires one employee to serve it, and every hotel room to be built would create an additional job. Furthermore, for every dollar spent by a guest in a hotel, one additional revenue dollar is generated across a wide range of businesses [10]. The World Travel and Tourism Council (WTTC) estimated the travel and tourism industry direct employment at 78.1834 million direct jobs (3.1% of world total) for year 2001, and the travel and tourism economy employment estimates (direct and indirect), at 207.062 million jobs (10.7% of world total) in year 2001.

In 2002, worldwide tourism experienced unexpected growth, and the number of tourist arrivals reached about 715 million passengers representing a 3.1% increase over 2001. Table 2 summarizes the worldwide regional arrivals growth during the period of 1995-2002 [11].

TABLE 2. INTERNATIONAL TOURIST ARRIVALS BY REGION (1995-2002)

Region	Arrivals (million)			Market share (%)		Growth Rate (%)	Avg. annual growth (%)
	1995	2001	2002	1995	2002	02/01	90- 00
Africa	20.1	27.7	28.7	3.6	4.0	3.7	6.1
Americas	108.9	121.0	120.2	19.7	16.8	-0.6	3.3
Asia & Pacific	85.6	121.0	130.6	15.5	18.3	7.9	7.2
Europe	323.4	401.4	411.0	58.8	57.5	2.4	3.6
Middle East	12.4	21.8	24.1	2.4	3.4	10.6	9.7
World Total	550.3	692.9	714.6	100	100	3.1	4.3

Source: World Tourism Organization (WTO), (Data as collected by WTO Jan 2003). Tourism Satellite Accounting Estimates and Forecasts (World Travel and Tourism Council (WTTC), 2002).

2. *Tourism in the ESCWA region*

ESCWA Member countries (MC's) are placing more emphasis on promoting tourism and realizing its importance for national economies. Tourism activities in the region fall into four main categories: religious (mainly pilgrimage), cultural and natural, and business. The sector is rapidly developing, and is expanding in most MC's to become a prominent economic sector, especially in Egypt, Jordan, Lebanon, and UAE. The number of hotels has been consistently increasing due to the public and private investments in the sector and tourism receipts have increased significantly over the last decade in most member countries. It is also noticeable that almost 90% of the hotels are being merged and operated by international hotel chains and by operators from the region. Very few countries, however have adopted measures to encourage the sustainability of the sector. Annex (I), presents a brief of some of the policies and activities developed in ESCWA MC's to promote tourism in general, and eco-tourism in particular.

According to WTTC, the Middle East's Travel & Tourism Industry, including that of ESCWA countries, direct impact is expected to generate US$16.3 billion in 2003 (2.8% of GDP) and forecast to reach US$34.0 billion (3.5% of total) by 2013. Industry direct employment is estimated at 1,238,000 jobs (3.4% of total) in 2003 and forecast to grow to 1,822,300 jobs (4.1% of total) by 2013 [12]. These figures are indicative for the expected growth of the sector in the ESCWA region.

Due to the detrimental effects of September 11, and the global economic slowdown, the tourism industry in the region experienced a significant decline of approximately 8% in tourist arrivals of in 2001. However, tourist arrivals in 2002 experienced a recovery, registering, according to World Tourism Organization (WTO), a growth of approximately 7% and arrivals in that year accounted for 3% of total worldwide tourist arrivals.[3]

The region is planning substantial investments in tourism and hospitality sectors. Table 3 presents recent and expected hotel supply developments in several countries of the ESCWA region. As indicated in this table 96 new hotels comprising of around 24,000 rooms will be developed during the period 2002-2006. These new hotel developments are mainly geared towards five-star and four-star hotels. Only 10% of the planned new branded hotels supply representing three-star and budget hotels [3].

TABLE 3. RECENT AND EXPECTED HOTEL DEVELOPMENTS IN THE ESCWA REGION

Country	Number of Hotels	Number of rooms	Expected date
Bahrain	8	1145	2002-2003
Egypt	27	8000	2003-2006
Jordan	8	1536	2003-2004
Kuwait	4	771	2002-2004
Lebanon	7	1787	2002-2006
Oman	9	2524	2003-2004
Qatar	7	1668	2002-2004
Saudi Arabia	3	444	2002-2003
Syria	3	602	2003-2004
UAE	20	5944	2002-2005
Total	96	24,076	2002-2006

Source: E. Younes and D. Bourdais. Middle East Hotels – Trends and Opportunities, HVS International, 2003 Edition..

Tourism receipts, as shown in Table 4, account for all expenditures by foreign visitors to ESCWA region, including payments to national carriers for international transport [14]. These receipts also include all payments for goods, lodging, and other services received in the destination country. Table 5 show statistics related to the number of visitors and number of hotel beds, respectively, in the ESCWA MC's.

TABLE 4. TOURISM RECEIPTS (MILLION US$) RECORDED IN SOME ESCWA MEMBER COUNTRIES

Country	1995 [1]	1998 [1]	2001[2]
Bahrain	247	366	469.0 (M)
Egypt	2684	2564	4.3 (b)
Jordan	661	853	722.0 (M)
Kuwait	121	207	98.0 (m)
Lebanon	710	1221	742.0 (M)
Oman	92	-	120.0 (M)
Saudi Arabia	1140	-	-
Syria	1338	610	1.1 (b)
Yemen	50	84	76.0 (M)

Sources: 1- The World Bank Group: Website: www.devdata.worldbank.org/external/dgcom.asp
2- Statistical, Economic and Social Research and Training Centre for Islamic Countries. Website: www.sesrtcic.org/statistics/data [14]

As shown in Table 6, the hotels occupancy rates in the ESCWA region during the period (1998-2002) have been fluctuating between 45% and 78 percent. The lowest occupancy rate were recorded in Jordan and Kuwait while the highest rates are in Egypt and UAE[12] depending on the number of tourists and on the size of investments in the sector.

TABLE 5. NUMBER OF VISITORS AND HOTEL BEDS IN MEMBER COUNTRIES (1995-2000), IN THOUSANDS[14]

Country	No. of Visitors		No. of Beds	
	1995	2000	1995	2000
Bahrain	1396	2420	6,19	9,00
Egypt	2871	5506	13,56	227,22
Iraq	325	0	53,07	52,96
Jordan	1074	1427	20,61	34,43
Kuwait	69	78	3,47	2,86
Lebanon	450	742	16,42	25,45
Oman	279	571	4,22	7,86
Palestine	230	330	6,38	12,16
Qatar	294	431	2,51	3,12
Saudi Arabia	3325	6296		
Syria	815	1416	31,45	34,21
UAE	1601	3907	34,84	49,30
Yemen	61	73	13,66	26,01
Total	12790	23197	32,85	484,58

Source: Statistical, Economic and Social Research and Training Centre for Islamic Countries. Website: www.sesrtcoc.org/statistics/data

TABLE 6. HOTELS OCCUPANCY RATES (%) IN SELECTED MAJOR CITIES IN THE ESCWA REGION [12]

Country	1998	2000	2002
Bahrain, Manama	58	59	64
Egypt, Cairo City Center	78	78	68
Jordan, Amman	56	59	45
Kuwait, Kuwait City	46	46	53
Lebanon, Beirut	61	57	57
Oman, Muscat	56	55	59
Qatar, Doha	72	58	60
Syria, Damascus	69	66	67
UAE, Abu Dhabi	66	67	68

Source: World Travel and Tourism Council, "Agenda 21 for the Travel and Tourism Industry. Towards Environmentally Sustainable Development". www.wttc.org

3. *Environmental impacts of tourism development*

The economic health of tourist facilities, particularly in coastal areas, depends largely on maintaining the quality of its primary resource: the environment. However the tourism industry has a broad range of impacts on environment, depending on the type of tourist facility, site specifics and systems used. The sector is a large consumer of natural resources, mainly land, water, and energy resources as well as food, and other commodities. Therefore, it has detrimental effects on local inhabitants, especially during peak sessions where there may be insufficient power, water and fuel for all, as well as generating significant quantities of waste and emissions**.**

Energy use in tourism sector if not appropriately and efficiently managed can have significant expense to the environment and to the community, including contribution to global warming and climate change through emissions of green house gas which could put some of the primary tourist attractions at risks and endure heavy loses on the tourism industry if these areas were destroyed. Urban air pollution are also affecting some of the worlds most important tourist attraction destinations. Acid rain, which occurs when emissions of sulfur dioxides produced during burning fossil fuel, can impair the health of tourists and local people as well as contribute to the corrosion of historic buildings and other monuments.

The tourism impacts on land and water resources are exerted, through the use of untouched natural areas for resort and other tourist development, and discharge of poorly or untreated sewage and wastewater lead into deterioration of water quality where people can swim, sail and fish for good business. In addition, the absence of building and planning regulations, tourism development can cause problems of litter, waste and effluent disposal as well as traffic congestion.

For example, Tourist Villages on coastal areas are in most cases isolated from sources of power and water, and have no easy or inexpensive access to disposal facilities, each resort development has potential impacts on a broad range of natural resources, from those of the open sea waters to people, desert animals, plants, and antiquates. Table 7 describes the major environmental issues in terms of sources and impacts that are potentially associated with tourist village construction and operation in coastal areas [(4)]. These sources include: Brine Discharge; Sewage Discharge; Trash and Garbage; "Solid Waste"; Accidental Liquid Discharges (e.g., from vehicles and other machinery); Soil Erosion and Deposition; Cutting, Filling, and Regrading; Runoff from Impervious Surfaces (e.g., parking lots, walkways, patios, etc.); Noise Generated by Mechanical Systems, Vehicles, etc.; Air Emissions Generated by Generators and Other Equipment; Reef Disruption; Harvesting of Marine and Terrestrial Plants and Animals for Recreational, Commercial, or Industrial Purposes.

In conclusion, tourism has a vested interest in maintaining the quality of environment, a key resource, as well as maintaining clean and efficient utilization of environmental resources are critical for successful tourism. Therefore, tourism business need to reduce the use of resources and the production of waste and emission through a cohesive range of design and environmental measures, including actions for good energy management, which makes it possible to incur profit and reduce the threat on the environment. Environmental protection and sound environmental management during resort planning, construction, and operation are therefore the most critical investments that a developer will make over the life of a particular facility. On a practical level, environmental protection at the tourist village will only occur where the management makes it a high priority.

B. Concepts, goals, priorities and measures

1. Concepts and goals

The concept of sustainable tourism development "STD", has been developed within the same framework and requirement identified for sustainable development by Agenda 21.[(15)]

<u>Sustainable Tourism Development refers to</u> tourism development that satisfies the needs of the coming generations without limiting future tourism options through the appropriate management of natural resources and its protection from deterioration. It aims at achieving several goals, of which are:

(a) Protecting the environmental processes and supervising tourism development activities in order to avoid the deterioration of these processes.

(b) Encouraging sustainable production and consumption patterns.

(c) Preserving the environment from polluting factors and integrating the environment aspect in the tourism activity management.

(d) Encouraging the eco-tourism for preserving the natural resources and the environment.

(e) Not sacrificing the cultural heritage or the local culture in tourism development areas.

(f) Spreading environmental awareness to the local people in the tourism development areas and those who participate in all the tourism activities.

TABLE 7. MAJOR ENVIRONMENTAL PROBLEMS ASSOCIATED WITH TOURIST VILLAGE CONSTRUCTION AND OPERATION IN COASTAL AREAS [4]

Issue	Sources	Impacts
Coral reef degradation	Siltation, sewage dischare, brine discharge, oil spills, physical destruction (dynamiting, over-fishign, souvenir hunting, boat mooring).	Kills coral and associated marine life, reduces recreational opportunities for tourist.
Odor	Malfunctioning sewage treatment facilities, garbage and other solid waste, chemical discharge (lubricants, coolants, etc.).	Disturbs tourist, creates bad impression, attracts insects and other vermin.
Windborne trash	Improperly supervised solid waste disposal system (landfill, trash cans, etc.).	Reef damage, attracts insects and other vermin, can harm wildlife, despoils landscape.
Destruction of terrestrial and marine wildlife habitat	Construction, vehicle, or pedestrian travel, disposal of wastes (brine, sewage, trash, chemicals, etc.), cutting and filling, erosion, over-harvesting.	Relocation or death of wildlife.
Land erosion	Cutting, filling, regrading, runoff.	Damage of roads, buildings, and other structures, wildlife habitat damage, siltation of coastal waters.
Noise	Power and water production, vehicle traffic, entertainment (music, etc.).	Disturbs guests, disturbs wildlife.
Air pollution	Engine operation (vehicles, generators, etc.) boiler operation, kitchen operation.	Disturbs guests, disturbs wildlife.
Coastal water pollution	Sewage and brine discharge, silt borne by runoff, windborne trash and garbage, discharges from boats.	Kills coral and associated marine life, reduces recreational opportuinities for tourists.

* *Source:* New and Renewable Energy Authority, NREA and USAID, "A Guide for Preliminary Planning and Assessment of Energy Efficient and Environmentally Sound Tourist Villages in Remote Areas of the Sea Coast of Egypt". Cairo, Egypt, 1991.

In addition the World Tourism Organization (WTO) in 2003, in the context of the United Nations sustainable development process, has developed a revised definition for the concept of "STD", which is:

Sustainable Tourist Development is the "tourist activities leading to management of all resources in such a way that economic, social and aesthetic needs can be fulfilled while maintaining cultural integrity, essential ecological processes, biological diversity and life support systems".(16)

As encouraging eco-tourism is a core goal for achieving STD, the UNEP and the WTO have declared 2002 as the International Year of Eco-tourism (IYE), by which they have demonstrated their recognition to the social and economic role that this sector can have on global scale, being a small but rapidly growing industry. The core objective of the "IYE" was to generate greater awareness and exchange experiences among all concerned groups regarding eco-tourism capacity to support sustainable tourism development.

The concept of eco-tourism, as adopted by the WTO and other international organizations, reflects all forms of tourism in which the tourists' main motivation is the observation and appreciation of nature, that contribute to the conservation of, and that generate minimal impacts upon the natural environment and the cultural heritage.(17) A general consensus has been formed for the basic elements of eco-tourism. These being to:

(a) Require the lowest possible consumption of non-renewable resources.

(b) Involve responsible action on the part of tourists and the tourism industry.

(c) Contribute to conservation of biodiversity.

(d) Sustain the well being of local people.

(e) Include an interpretation/learning experience.

(f) Be delivered primarily to small groups by small-scale resources, and

(g) Stress local participation, ownership and business opportunities, particularly for rural people.

2. Priorities and measures

In 1996, three of the concerned international organizations, the World Travel and Tourism Council, the World Tourism Organization, and the Earth Council, jointly prepared a work plan entitled "Agenda 21 for the Travel & Tourism Industry Towards Environmentally Sustainable Development".(12) In general, the plan depends on Rio proceedings and its documents (the "Rio Declaration on Environment and Development" and "Agenda 21).(15) The plan has specified a set of work priorities that serve the sustainable tourisms development goals(12), one of them is specifically on energy and all others are energy relevant in a way or another. These are:

(a) Planning processes that accomplish sustainability goals.

(b) Improving the energy efficiency and regulating its use.

(c) Good management for fresh water resources.

(d) Limiting the production of wastes by re-using and recycling it.

(e) Good management for liquid and hazardous wastes.

(f) Managing the transportation sector, and wise land use.

(g) Promoting partnership for sustainable development and encouraging the participation of workers, agents, and local communities in the environment related issues.

In 2002 the JPOI, endorsed by WSSD, in its Article 41 has called for adopting measures for promoting sustainable tourism development, including non-consumptive and eco-tourism, taking into account the spirit of the International Year of Eco-tourism 2002, the United Nations Year for Cultural

Heritage in 2002, the World Eco-tourism Summit 2002 and its Quebec Declaration. This also includes the Global Code of Ethics for Tourism as adopted by the World Tourism Organization in order to increase the benefits from tourism resources for the population in host communities while maintaining the cultural and environmental integrity of the host communities and enhancing the protection of ecologically sensitive areas and natural heritages. Promote sustainable tourism development and capacity-building in order to contribute to the strengthening of rural and local communities. This would include actions at all levels to:[(5)]

(a) Develop programmes, including education and training programmes, that encourage people to participate in eco-tourism, enabling indigenous and local communities to develop and benefit from eco-tourism, and enhance stakeholder cooperation in tourism development and heritage preservation, in order to improve the protection of the environment, natural resources and cultural heritage;

(b) Provide technical assistance to developing countries and countries with economies in transition to support sustainable tourism business development and investment and tourism awareness programmes, to improve domestic tourism, and to stimulate entrepreneurial development;

(c) Assist host communities in managing visits to their tourism attractions for their maximum benefit, while ensuring the least negative impacts on and risks for their traditions, culture and environment, with the support of the World Tourism Organization and other relevant organizations;

In addition, Article 19 of JPOI, calls upon Governments, as well as relevant regional and international organizations and other relevant stakeholders, to implement, taking into account national and regional specificities and circumstances, the recommendations and conclusions of the Commission on Sustainable Development concerning energy for sustainable development adopted at its ninth session "CSD-9", bearing in mind that in view of the different contributions to global environmental degradation, States have common but differentiated responsibilities.[(5)] The issues and options set by Article 19 have acknowledged tourism as one of the major energy consuming sectors and requested countries to "take actions at all levels to integrate energy considerations, including energy efficiency, affordability and accessibility, into socio-economic programmes, especially into policies of major energy-consuming sectors, and into the planning, operation and maintenance of long-lived energy consuming infrastructures, such as the public sector, transport, industry, agriculture, urban land use, tourism and construction sectors".

C. ENERGY RELEVANCE AND INITIATIVES

1. Energy Relevance

Energy systems and services are crucial for all phases of the tourism facilities design, construction and operation, particularly for tourist villages in coastal and remote areas, which may need to supply their own power, water-treatment, etc. Electricity and thermal energy are the main energy forms used in the tourism facilities for necessary services. Electricity is used throughout the tourist village for a broad range of tasks, including lighting, water heating, air conditioning, plumbing, laundry operations and desalination. The most obvious used thermal energy is for hot water in guestrooms, the kitchen and the laundry. Building climate controls is another important thermal load for heating and cooling of guest rooms and other enclosed spaces. Depending on the technology chosen, on-site desalination, if required, can also represent a significant thermal load at the tourist village. These energy services can be made available through different system options which differs in both cost and associated environmental impacts, particularly at off-grid sites. Table 8 shows the major system options for energy services in tourist facilities.

TABLE 8. MAJOR SYSTEM OPTIONS FOR ENERGY SERVICES IN TOURIST FACILITIES

Electricity supply	Thermal energy supply	Building climate control and general services
• Grid connection	• Petroleum-based fuels	• Passive cooling
• Diesel generators	• Solar water heating	• Energy management and control systems (EMCS)
• Gas turbines	• Waste heat / cogeneration	• Distributed and central cooling system
• Photovoltaics	• Hot water storage	• Ice storage
• Wind electric systems	• Seawater active / passive cooling	• Desiccant dehumidification
• Hybrid systems		• Occupancy sensors / key cards
• Solar thermal		• Laundry equipment
		• Kitchen equipment

Source: New and Renewable Energy Authority NREA, Egypt and USAID, "A Guide for Preliminary Planning and Assessment of Energy Efficient and Environmentally Sound Tourist Villages in Remote Areas of the Sea Coast of Egypt", 1991

The energy bill constitutes a substantial share in the tourism sector's operational expenses that sum up to 3-6 percent on average of the total operating expenses.(18) However, the cost of energy is not just a business expense, its generation and use can also be a significant damage to the environment and to the community. For a sector that relies directly or indirectly on burning fossil fuels to run its operation, the environmental expense generally shows up in local environmental problems such as air quality degradation, water pollution, and toxic waste, in addition to global problems such as glob al warming and ozone layer depletion. Such impacts that can have a direct effect on a tourism business by reducing the desirability of tourism destinations.

Mitigating this damage will require improving energy efficiency and energy management in the tourism sector in general and the hotel sector in particular, which represents an indispensable part of a comprehensive environmental management, which is considered one of the appropriate tools towards improving the competitive capability of tourism facilities regarding the cost of providing the efficiency of the energy-using systems and equipment.

In view of the above, there are multiple benefits of improved energy and environmental management in tourism establishments:

- 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.

2. *Current Initiatives*

In recognition of the critical role of energy in achieving sustainable tourism development, and in response to the set work priorities identified by the "Agenda 21 for Travel and Tourism Industry" as well as Articles 19 and 41 of JPOI, different national and international tourism organizations have designed and implemented a number of initiatives and schemes that include positive steps towards energy for sustainable development, incorporating many of the working priorities listed above into their practices. Some of these initiatives are briefly discussed below in order to identify the positive steps they have taken towards enhancing energy management and efficiency in support to the tourism sector sustainability.

(a) *Green Key (Denmark):* It is one of the most stringent eco-certification programs in the world. Established in Denmark in 1994, it has become an international eco-label covering hotels in Sweden, Greenland, and Estonia. To qualify for certification, hotels must meet 78 criteria starting with creating an environmental policy, and site-specific action plans, waste separation and collection of recyclable materials, measures limiting water, heat, and electricity consumption, use of eco-friendly suppliers and detergents, and of organic foods on the menu. In 2000, Denmark launched a certification program for destinations – Destination 21 – which sets out eight sustainability goals covering the three principle pillars of the Rio Summit: economic, social and environmental sustainability.

Over the last four years, HORESTA, a Danish company, on behalf of the Danish Energy Agency, has led an energy saving campaign for the entire industry – 14,000 businesses – which has exceeded its goal of reducing energy consumption by 5% to 10%.[19]

(b) In 1994, WTTC established 'Green Globe': a voluntary environmental management certification program designed specifically for travel and tourism industry. In 1999 it became an independent organization Green Globe 21[20], which provides guidance material and certification based on both ISO standards and Agenda 21 principles.

(c) *Caribbean Alliance for Sustainable Tourism (CAST):*[21] developed by the Caribbean Hotels Association with the support of WTTC, the International Hotels Environment Initiative and the Caribbean Tourism Organization. It develops training workshops and materials on themes such as environmental management systems, energy efficiency and wastewater management.

(d) *Taj Hotels* 'Green Technology':[22] promotes alternatives which reduce energy consumption and reliance on fossil fuels, eliminates the use of ozone-depleting substances, and promotes reduction in use of non bio-degradable materials, while implementing wastewater treatment and reuse of water, use of solar energy, use of environment-friendly detergents in laundries and vermiculture. The Environmental policy of Taj is program specific and meets all aspects of the ISO 14001 framework. To motivate staff and involve guests and community, many environment programs are also conducted periodically across the company.

(e) *ECOTEL:*[19] It is an HVS International's certification program, focuses on energy efficiency, waste *management and recycling, water conservation, legislative compliance and employee* environmental education and training. The auditing process leads to the development of property-specific action plans. Additionally, a detailed cost-benefit analysis of projected savings is prepared. The auditing inspection is stringent, with the auditors present on the property for up to 30 hours and extensive interviewing of hotel staff. To date 34 hotels have obtained ECOTEL certification, which uses a graduated five Globe award system.

(f) *ENERGY STAR*™:[23] In June 2002 the U.S. Environmental Protection Agency (EPA) announced an ENERGY STAR™ energy performance-rating to help USA hotels energy performance. This tool allows hotels to rate their energy efficiency and benchmark their performance on a national scale. Those that achieve a high level of performance will be allowed to display the ENERGY STAR™ label. Close to $5 billion is spent by the hospitality industry annually on energy bills. Working to improve energy efficiency by an average of 30 percent would save approximately $1.5 billion in energy costs, and reduce emissions of the greenhouse gas carbon dioxide by nearly six million metric tons.[11]

II. ENERGY SUPPLY OPTIONS AND CONSUMPTION PATTERNS IN THE TOURISM SECTOR*

The hospitality industry, as the major sub-sector of the tourism sector, constitutes one of the most energy- and resource-intensive sectors. Substantial quantities of energy are consumed in providing comfort and services to guests, many of who are accustomed to, and willing to pay for exclusive amenities, treatment and entertainment. The energy consumption cost accounts for about 3% to 6% of the total operational cost and constitutes a factor that can influence the bottom line profit in the hospitality sector.(18) The energy efficiency of the many different end-users in hotel facilities is frequently low, and the resulting environmental impacts are therefore, typically greater than those caused by other types of buildings of similar size.(24)

Meanwhile, the energy use varies substantially between different types of hotels, and is affected by hotel size, class/category, the number of rooms, customer profile, location (rural/remote or urban) climate zone, as well as by the types of services/activities and amenities provided to guests.

This chapter presents a brief description and analyzes the different energy supply options for tourist facilities indicating their suitability for different energy usage in the sector. It also discusses the typical loads energy consumption profiles for different energy applications together with the impacts of the operating conditions on such patterns.

A. ENERGY SUPPLY OPTIONS

Energy is supplied to the tourism facilities and hotels through different alternative options depending on the geographic location, the availability/accessibility of the energy resource, the nature of required services and the cost of the alternative technologies and systems available. Currently, the most used energy supply options for hotel services are always in one of two forms; either electrical energy or thermal energy, each can be supplied to the required application through different energy technology or system options. These options are briefly discussed in the following sections.

1. Electrical energy

Electrical energy is the most important source of energy necessary for fulfilling the needs of tourist facilities used for water heating, heating ventilation & air conditioning (HVAC) systems, elevators operation, lighting, kitchen and laundry, as well as desalination and wastewater/sewage treatment (if applicable). Electricity can be supplied to tourism establishments through different system options including: connection to either national grids or local electricity networks, diesel power generation units and renewable energy electricity systems. In all cases, the required peak power load and total annual electricity consumption are the two most important design considerations to determine the required capacity of the power supply system. The main characteristics, advantages and disadvantages of each of the electricity supply options are described hereinafter and summarized in Table 9.

(a) Connection to the Electricity Network Grids (18)

Connection to electricity grids is the most widely used option for tourism establishments that are located in existing urban areas. This alternative is the least expensive since it saves the investments necessary for the establishment and operation of the generating units and transmission networks that the electricity companies or local management units are responsible for. Usually, tourism establishments pay for the costs of connecting to the network plus the cost of electricity consumption. Moreover, this alternative dismisses the facility management from the responsibility of the management and maintenance of electrical energy generation units. From an economic point of view, electricity production from large stations is a better alternative than the small stations, due to the fact that they are more efficient and consequently, have less negative environmental impact. As for the disadvantages of this alternative, they are revealed in the lack of

* The tourism sector, as considered in this chapter, includes the hospitality sub-sector and excludes Travel Agencies and Tourist Guides.

emergency units that can be operated by the tourism facility in case of loss of connection with the network for one reason or another.

TABLE 9. SUMMARY OF THE MAIN ELECTRICITY SUPPLY TECHNOLOGY OPTIONS TO TOURIST FACILITIES

Technology	Advantages	Disadvantages	Comments
Conventional Systems			
Grid Connection	Least initial cost, for high-required capacities. Minimal O&M requirements. Minimal local environmental impacts.	Lack of units, to be operated in case of emergency. May require extension of the grid.	It is the best option for choice, if a reliable power grid is available.
Diesel Units	Well-known and widely used technology. O & M are readily available.[*1] High Reliability.	Less efficient and more costly than grid connection. Highly dependent on fuel & transportation costs. Needs large storage for fuel. Generates noise and pollution.	Commercially available and are usually chosen for remote power applications.
Renewable Energy Systems [*2]			
Photovoltaic (PV)	Systems are simple and equipment operation is reliable. No fuel input required.	Storage batteries may be required for nighttime operation. Other applications like pumping do not need storage.	Standalone PV systems are appropriate for remote applications with small capacities..
Wind Electric Turbine	Systems are simple and equipment operation is reliable. No fuel input required. Wind farms can be connected to the electricity grid and supply steady power.	Cost of operation highly dependent on the wind regime on site. Standalone wind electric systems, save energy but not capacity.	Standalone wind power systems are appropriate for remote applications where continuous power is not required, or where storage batteries can be used for backup. Wind farms are suitable for grid connection.
Renewable/ Diesel Hybrid	Maximize the use of renewable energy while supplying continuous power by means of the diesel backup system. Limited emissions. High Reliability	Increased complexity of system and additional equipment. Require additional maintenance	Renewable energy/diesel hybrid systems are often the most cost-effective choice for remote power.

[*1] O & M, Operation and Maintenance

[*2] Solar thermal systems are commercially available, particularly combined with gas turbines, however they are recommended for large scale, grid connected projects, and not for remote applications until they have been demonstrated in Egypt.

(b) Diesel-fueled Power Stations [18]

This alternative is the most widespread energy generation option for tourism facilities located in areas where connection to the network is costly or there is no connection to the national grid or local electrical network. In this alternative, small diesel power stations are usually installed to fulfill the needs of one or more of the tourism establishments in a certain area. Such systems can be dependable and under complete control of the facility management, provided that the fuel supplies are secured and the necessary operation and maintenance capabilities are available on site.

The drawbacks of diesel units include mainly the need for continuous and expensive maintenance, the need for storing large quantities of diesel fuel and transporting it to the site, and the short operational lifetime of the diesel units compared to large electrical power stations. From the economic point of view, the efficiency of operating diesel units for electricity production is less than that of the large units, therefore the cost of electricity production is higher than that generated from high capacity stations. Moreover, operating diesel units inside the tourism establishments generates noise, possible leakage to soil and groundwater, and air pollution which may affect negatively the attractiveness of the facility for potential visitors and tourists, and thus reduces its profits and sustainability.

(c) Renewable Energy Electricity Systems

Several renewable energy electricity generation systems are currently technically viable and can prove being economical under many circumstances, particularly in remote areas. Photovoltaic and standalone wind electric systems are recommended only for remote application loads with small capacities, such as pumping, communications sites, isolated road signs, or certain outdoor security lighting requirements. [25] Large scale wind farms and solar thermal electricity generation have approached maturity, however they are very site specific and better fit for high capacity grid connected applications. [26,27]

2. Thermal energy [4, 18]

Tourism establishments require thermal energy to provide several important services, including guest rooms heating, provision of hot water for use in bathrooms, kitchens, laundry, clothes drying and cooking, and sometimes for heating swimming pools and water desalination. A variety of thermal technologies are available for meeting such thermal loads, these include: fossil-based systems, solar water heaters, cogeneration and hot water storage. However most tourist facilities satisfy their thermal requirements by using electricity, although the direct thermal means are reliable and can be more cost effective. A brief discussion of these options for hot water and cooking is described in the following sections, while Table 10 summarizes the characteristics of the main thermal technologies considered for providing thermal energy to tourist facilities.

(a) Single Electric Water Heaters

This alternative is widespread in underdeveloped areas where small heaters for each guest room are installed in addition to, other heaters for general use like kitchens, laundry and others. It has a relatively lower investment costs and installation expenses. It is also flexible, as hot water is produced only when needed and in relatively small quantities. From economic viewpoint, it is the most costly and least efficient alternative as electricity is used to produce hot water compared to using diesel commercial boiler or any other fuel.

(b) Central Heating Units for Producing Hot Water

Hot water is produced in the hotel using central water boilers that run on diesel fuel, natural gas, or electricity. The choice of fuel depends on the geographic location of the hotel, number of rooms, and hot water demand level. As diesel fuel is cheaper, and in some countries is subsided, it is widely used in water boilers, in spite of its negative environmental impacts. If available and accessible, natural gas would constitute the best alternative both economically and environmentally compared with other alternatives (electricity, solar energy, etc). In all cases, operation and maintenance of central hot water production units inside the tourism establishments, requires the availability of high technical skills. Moreover, In the case of using diesel fuel, storing large amounts of diesel fuel presents an environmental hazard within the facility.

(c) Using Natural and Butane Gas in Cooking

In areas where natural gas is available, tourism establishments use it for heating and cooking purposes. As for those located far from such areas, butane gas cylinders are used if natural gas is available, is considered the best alternative both economically and environmentally. Electric cookers are also used in some cases particularly in large hotels.

TABLE 10. THERMAL ENERGY TECHNOLOGY OPTIONS SUMMARY

Technology	Advantages	Disadvantages	Comments
Fossil- Fuel Burning Equipment	Equipment, boilers or water heaters, are readily available, as are experienced operation and maintenance personnel.	Cost of thermal energy is directly tied to fuel costs. Problems of fuel transportation and storage to remote facilities.	Fossil-burning thermal energy systems are common and widely used for a variety of applications.
Solar Water Heating	System is simple to operate and maintain. Minimizes fuel cost for water heating, and more economic on lifetime basis. Minimum environmental impacts.	Initial cost of system is higher than conventional water heating system. Backup conventional system required.	Solar water heating should be considered for all tourist village hot water applications.
Cogeneration Waste Heat	Makes thermal energy available that would otherwise be wasted. Makes more efficient use of fuel used for power generation.	Operation and maintenance personnel may be unfamiliar with the equipment	Cogeneration should be considered as a first choice for thermal energy supply in large tourist facilities.
Oversized hot water storage	Provides extra thermal storage capacity for cogeneration, solar, or other discontinuous source of thermal energy, therefore reducing the need for backup supplies.	Increased size and cost of storage systems.	Thermal storage is strongly recommended if cogeneration or solar water heating is used.
Electric Heating System	Systems are simple to operate and maintain	Much higher cost than using thermal units. Add capacity required to electricity supply system.	Should be the last choice, if direct thermal alternatives are available.

B. Energy loads and consumption profiles

1. General considerations

Energy consumption within the tourism / hospitality sector is highly diversified and often difficult to grasp in detail. In effect, 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 profiles in tourist facilities would vary depending on a number of operating conditions or factors, including among others, 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. The rate of energy consumption is also influenced by the age and condition of the energy systems, which affects their efficiency. Such operating conditions, can be classified into three main groups:

(a) Facility Characteristics including, (1) type of facility "urban hotels, vocational villages, restaurants, etc", (2) 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 (1) 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:

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

   (ii) The Public area (reception hall, loopy, restaurants, meeting/ banquette 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).

   (iii) 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).

Several investigations were carried out around the world to determine typical energy loads and consumption patterns in tourist facilities, given due consideration for the different operating conditions in each case. Such type of surveys is aiming at obtaining a more detailed understanding of the energy flows in hotels, providing a valuable basis for estimating the required energy system capacities, and energy loads and consumption profiles of similar type facilities. The following spotlights the results of some of these surveys with special reference to those conducted in the Arab Republic of Egypt, mostly reflecting the conditions in ESCWA member countries.

2. Typical energy loads [4,18]

As mentioned earlier, the currently most used energy forms for tourist facilities are electricity and thermal energy. From a design standpoint, the most important electrical characteristics of a given tourist facility, are the peak electrical load and the daily, monthly, or annual electrical energy (kWh) consumption. Peak electrical loads are usually quantified as kilowatts per guest room (kW/room), obtained by dividing the peak electrical load of the entire facility by the number of guest rooms. It represents an important factor in determining the electrical generating capacity required for the facility.

On the other hand, thermal loads are quantified in British thermal units (Btu) per guest room per day, based on the type of application, operating temperature and the amount of fluid to be heated. Thermal energy can be produced by direct burning of fossil fuels, solar heat and by using electric heating systems. Electricity is the basic form of energy used for several end use applications in the tourist facilities, while it is also used frequently as a fuel for thermal energy end-use applications (e.g. water heating, cooking, etc.).

Based on the above and the outcome of studies performed in ESCWA MC's, the following is a brief on the estimated typical electric loads for the main end use applications in tourist facilities, namely space heating and cooling, water heating, lighting and other support services.

(a) *Space heating and cooling*

Although passive heating and cooling techniques (if applied) can reduce the space heating and cooling loads, the most important provider of cooling in both guest rooms and common areas of tourist villages is the air conditioning system. Space heating loads can be met using a number of possible methods, including electrical resistance heating or the combustion of fossil fuels. The average heating energy consumption for space heating varies between 1-3 kWh per guest room per day at about 30ºC. In contrast, cooling loads are usually met by using electrically driven compressors, however they can also be met by a heat source to drive an absorption cooling system.

In the Red Sea and south Sinai existing tourist villages air conditioning peak loads were recorded in summer, accounting for an average of 40-50 percent of the electricity consumed by the tourist village over the summer months. Each guest room in a typical tourist village is equipped with an air conditioner drawing an electrical load of approximately (1 kW). Average summer electrical consumption used to meet cooling loads in existing tourist villages varies from 2.6 (for 4-star facilities) to 7.6 kWh (for 5-star facilities) per occupied guest room per day.

(b) *Water heating*

Hot water production is the highest consumer of thermal energy in tourist facilities operations. The thermal energy needed for hot water production is proportional to the amount consumed and the production temperature. A reasonable design hot water consumption rate is 95 liters (25 gallon "gal") per guest per day. Assuming occupancy of 1.5 guests per room, this equals 143 liters (38 gal) per guest room per day. This includes hot water use in the rooms and elsewhere in the facility for kitchen and laundry needs. To produce this amount of hot water with electrical resistance to the required temperatures, varying between 50-80ºC for different applications, requires 6 to 12 kWh (20,000 to 40,000 Btu) per guest room per day.

(c) *Lighting and support services*

Lighting is a major energy consumer in tourist facilities. In guest rooms and public areas, the energy consumed in lighting depends on occupancy rate and working hours regime of the support services, while in public areas lighting is needed around the clock.

Studies indicated that lighting counts for 15-40 percent of the total energy consumption in the tourist facility depending on occupancy rate and the level of supporting activities. The energy consumption for support services (cooking and laundry, pumping, etc) would vary between 15-20 percent. Some studies estimated laundry consumption at 0.8-1.4 kWh/room/day.

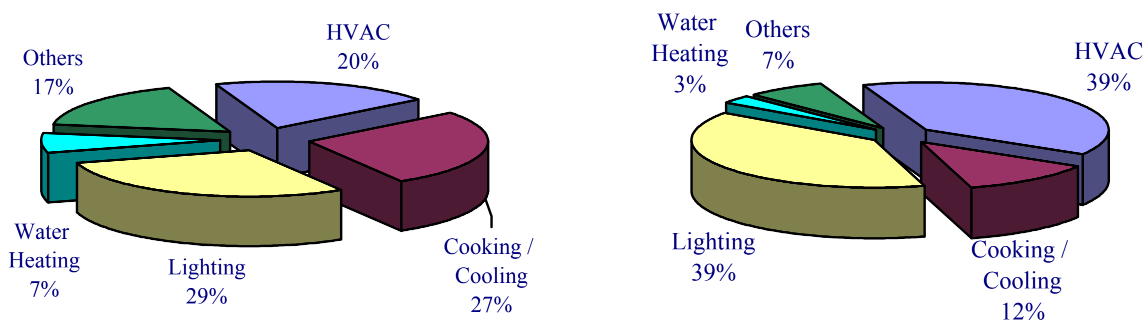
2. Energy consumption profiles

The energy consumption profiles in tourist facilities are affected by the type, size and category of the facility as well as the climatic conditions. The impacts of these factors are discussed below based on results of field surveys and studies conducted in the ESCWA MC's and the United States.

(a) *Impact of hotel category and size*

A study on two hotel categories (1-3 stars) and (4-5 stars) conducted in the Goveornate of Cairo revealed variation in energy consumption pattern between the two categories (2). As shown in Figure II, air-conditioning / heating / ventilation as well as lighting are the main energy users in the 4-5 star hotels, while energy for cooking use is the highest in the 1-3 hotel categories. The result of the same study indicated that the average qualitative electricity consumption in hotels of the first category is about 111 KWh/year/m^2 compared to 197 KWh/year/m^2 in hotels of the second category corresponding to 1.8 times its consumption in the first category.

Figure II: Energy consumption qualitative distribution in Greater -Cairo hotels



1-3 Stars *4 -5 Stars*

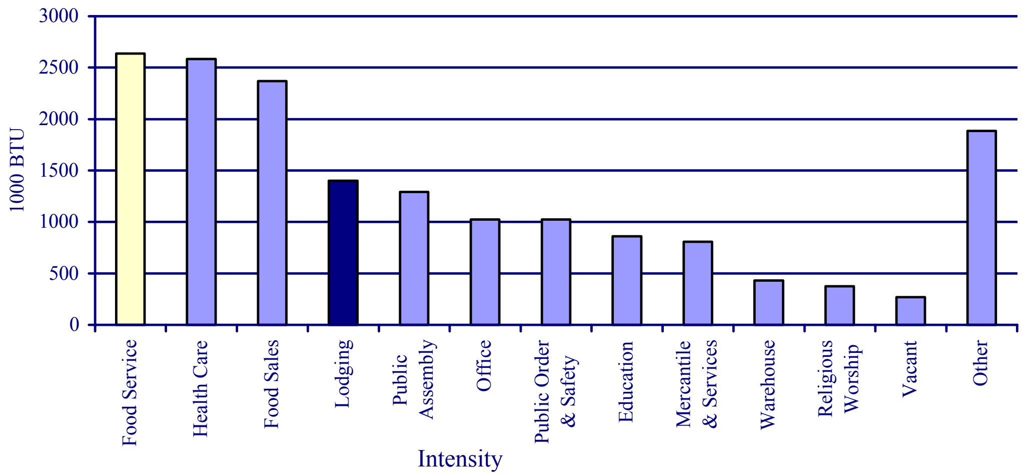
Source: I. Abdul-Jalil, consultancy report on Energy Efficiency in the Tourism Sector, Case of Egypt, 2003.

In addition, a number of surveys have been conducted worldwide to estimate the energy consumption per unit area in various commercial buildings including hotels and restaurants (28). The results (some of which are shown in Figure III) have indicated that restaurants have the highest energy intensity of all surveyed commercial buildings with a consumption rate in excess of 2.6 million Btu/m^2. Hotels, lodging business in general, ranked 4th with an energy intensity figure of around 1.4 million Btu/m^2.

The annual energy intensity would vary from around 157kWh/m^2 in typical one- star hotel up to around 450kWh /m^2 in luxurious 5-star hotels. Also water consumption would vary between 80 liters and 170 liters per room per day (28).

Meanwhile, based on some US studies to qualify energy consumptions, in hotels with different types and sizes, Table 11 provides a generalized rating for a rational (efficient) energy consumption for different types of hotels,(10) i.e. for good or fair efficient energy system the consumption should not exceed the values given in the table, for rating (fair), and a hotel with rating (fair) is practicing efficient energy use.

Figure III: Energy consumption in commercial buildings



Source: Energy Information Administration, Commercial Building Energy Consumption Survey, 1995

TABLE 11. RATIONAL ENERGY USE RATING FOR DIFFERENT TYPES OF HOTELS [(10)]

Energy Consumption ($kWh/m^2/year$) \ Rational Use	Good	Fair	Poor
Large hotels[*1]			
Electricity	< 165	165-200	>200
Fuel	< 200	200-240	>240
Total	< 365	365-440	>440
Hot Water	< 220	230-280	>280
Medium-sized hotels[*2]			
Electricity	< 70	70-90	>90
Fuel	< 190	190-230	>230
Total	< 260	260-320	>320
Hot Water	< 160	160-185	>185
Small hotels[*3]			
Electricity	< 60	60-80	>80
Fuel	< 180	180-210	>210
Total	< 240	240-290	>290
Hot Water	< 120	120-140	>140

Source: Energy-Efficiency and Conservation in Hotels-Towards Sustainable Tourism. (P. Bohdanowicz, A.Churie-Kallhauge, I.Marinac.), the 4th International Conference on Asia-Pacific Architecture, University of Hawaii at Manoa, Honolulu, USA, 2001.

[*1] Large hotels (more than 150 rooms) with air conditioning, laundry and indoor swimming pool.

[*2] Medium-sized hotels (50 -150 rooms) without laundry, with heating and air conditioning in some areas.

[*3] Small hotels (4 -50 rooms) without laundry, with heating and air conditioning in some areas.

(b) *Impact of Climatic Conditions*

The impact of climatic conditions on energy consumption trends has been clearly illustrated by a US study [(8)] that established a breakdown of energy consumption in hotels allocated in different climatic zones in USA. The results of Table 12 show that in cold regions, 31% of the electricity has been used for space heating whereas only 2% were recorded in hot regions. Similarly the power needed for air conditioning was 14% in hot regions compared to 4% in cold regions [(29)].

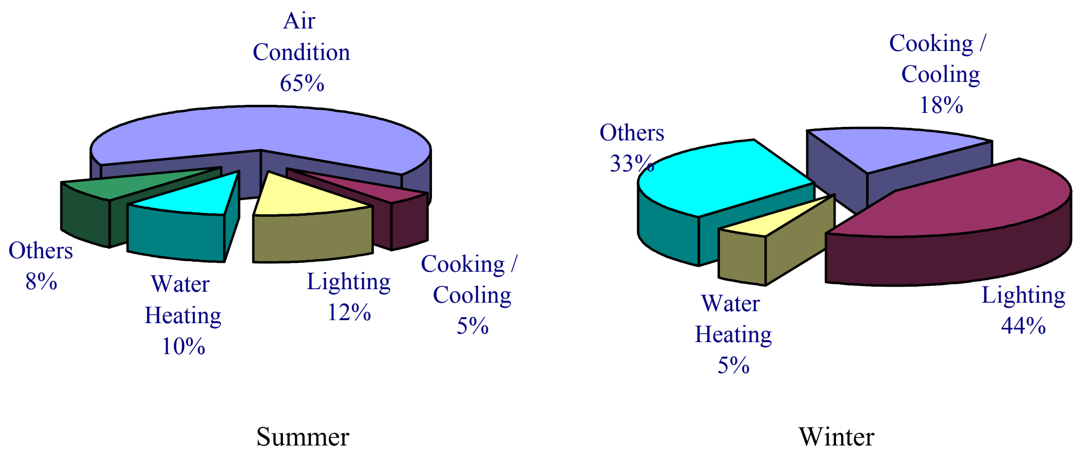
TABLE 12. COMPARISON OF PERCENTAGE USE OF ELECTRICITY
BETWEEN DIFFERENT CLIMATIC ZONES IN USA

	Cold Zone	Moderate Zone	Hot Zone
Water Heating	30	36	33
Lighting	19	24	29
Space Heating	31	10	2
Space Cooling	4	7	14
Others	16	23	22

Source: Managing Energy Costs in Lodging Sector, Website: www.wisconsinpublicservice.com/buisness/PDF/WPS

The effect of climatic conditions between summer and winter electricity consumption was also investigated in Egypt for hotels (1-3 stars) in the Governorate of Port Said. They showed that the largest amount of electric energy used in summer is for air conditioning (65%) and only 12 per cent for lighting compared to 44 per cent for lighting used during winter (44 %)[(2)]. These hotels consistently have higher electricity consumption in the summer season due to increased occupancy rate and the hot climate, which increases use of air conditioning systems (a prevailing condition in the ESCWA MC's) [(18)].

Figure IV: Electric energy consumption pattern of hotels in Port Said Governorate



Source: Ibrahim Abdul-Jalil, Energy Efficiency in the Tourism Sector, Case of Egypt, 2003.

In conclusion, it is noted that the figures of energy loads and consumption profiles given in this chapter, should be considered as indicatives to illustrate the issues discussed. Meanwhile, the following should be considered while developing or managing tourist facilities:

(i) The developers, designers and operators of any tourist facility should carefully study the facility specific energy needs, loads and consumption patterns, in light of the issues discussed in this chapter, and with a core design objective to reduce peak energy loads as possible, without compromising tourist needs and comfort.

(ii) Energy efficiency and conservation strategies should be a major concern in the selection and use of energy end-use systems for the tourist facilities.

III. ENERGY SYSTEMS FOR TOURISM: DESIGN STRATEGY, SYSTEMS APPROACH AND MANAGEMENT

Given the importance of promoting Sustainable Tourism Development (STD) in ESCWA MCs, the planners, engineers and architects are facing a significant challenge in the development of tourism facilities, regarding the design of systems for services such as energy and water supplies, as well as wastewater treatment. The design of such systems can play a pivotal role in the success or failure of the tourist facility and therefore deserve special attention by all partners at the very outset of the facility development project.(4)

Since energy systems are an integral element of the design, construction and operation of all kinds of tourist facilities, the appropriate planning, design and management of energy systems, particularly for efficient energy use, emissions and pollution reduction, and sustainable management of local resources, are of prime importance in promoting sustainable tourism development. In addition, systems that are designed, installed, or operated improperly can ruin the area's major tourist attraction: the environment. When the cost of energy and the potentially devastating environmental impact of an ill-planned tourist facility are added to the picture, the need for sound guidance on planning, designing and management of the energy systems becomes clear.

Given the above, Article 41 of the "JPOI" has called, among other issues, for adopting measures for developing capacity building and tourism awareness programmes in support of the STD. In response, ESCWA decided to develop this guide with the primary objectives to help public and private sector planners and developers, as well as the management and operating staff, in the tourism sector in ESCWA MCs, to: (1) understand the interrelationships among the major systems required for a successful sustainable development of tourist facilities "hotels and tourist villages" with focus on the required energy systems, and (2) to conceptualize and recommend options for energy systems, design and management that minimizes the consumption of scarce energy resources and reduce the energy systems environmental impacts.

In view of the above, this chapter is responding to the second objective by discussing the required design strategy and approach for energy systems, within the overall planning and design phase of the tourist facility. Meanwhile, it recommends a set of design options and guidelines that can improve energy management and upgrade the energy production and use efficiency in the tourist facilities.

A. DESIGN STRATEGY AND SYSTEMS APPROACH

The design, construction, and operation of tourist facilities, particularly tourist villages, are very site-specific tasks. They depend heavily on the specific geographic location of the site, the terrain, the degree of services, desired, and the targeted clientele. To perform these tasks, the developer must secure the services of qualified design team of professionals in numerous fields including: Facilities and Landscape Architecture, Hotel Management; Market Analysis; Legal Services; Construction Management; Environmental, Civil, Mechanical, Electrical, and Plumbing Engineering; Interior Design; Kitchen and Laundry Design; Marketing and Graphics Design.(4)

The task of the design team is a challenging one because they must balance a number of sometimes conflicting priorities, such as: remaining within the construction budget; maintaining good engineering practice; providing a facility that can be operated economically; creating minimal environmental impact throughout the construction and operation periods; and fulfilling the wishes of the developer.

Meanwhile, the team is faced with important decisions on the major mechanical systems as well as myriad of smaller pieces of equipment required for smooth operation of the facility. Since most of the systems that are chosen will interact with other systems and equipment in the facility, one design choice will have significant impact on other design decisions.

Therefore, the design team should embark on a clear design strategy and use a "systems" approach in making design decisions. Therefore, this approach should take a broad view of the planned facility and investigate the potential interactions among the major design elements.

1. The design strategy

The tourism industry is extremely competitive and has a low profit margin; consequently, one important objective for any developer is to reduce the operating costs of the tourist facility. In addition two important factors in tourist facilities design are, guest comfort and ease of access to services and recreational facilities. Therefore, the developer and the design team should carefully review the requirements and resources available at the specific site and set a clear strategy that help them design a facility that is integrated with itself and its environment while satisfying the set requirement and profit. The design strategy should take into consideration the followings:

(a) *For the facility overall design*

(i) To consider a "whole building design" approach, during the initial planning stages, where the building structure and systems are examined to determine how these can be best managed and operated to save energy and reduce environmental impacts.

(ii) To integrate the architectural design with the building's energy design. This would improve the building's performance through: selecting building materials that can reduce buildings thermal loads, incorporating passive and active solar technologies to help meet space climatization and lighting loads.

(iii) To consider carefully the physical layout of the tourist village and clustering of service areas to minimize electrical distribution systems, centralize plumbing and water supply, and minimize transportation requirements. This will reduce operating cost by increasing energy end-use efficiency.

(iv) To ensure guest satisfaction thought the use of reliable supplies of power and water, as well as the reliable operation of other support systems. Designs favoring reliability will pay off in developing guest satisfaction and repeat business.

(v) To enhance staff information and promote their participation in the development process of the facility, based on appropriate training and education programmes for them early enough in the process. Moreover, the owner/operators commitment to environmental protection must be clear and explicit.

(b) *For energy systems design*

(i) Goals for energy performance and consumption patterns have to be set early in the planning stage to maximize the potential savings and integrate systems designs as appropriate.

(ii) As appropriate, the energy supply system should minimize the use of fossil-fueled power generation technologies and maximize the use of cost-effective renewable energy technologies.

(iii) The strategy for managing energy consumption should target the reduction of both electrical and thermal peak loads, to reduce system size and upgrade energy efficiency.

(iv) The electrical supply system is to be designed as to provide the lowest real cost-of-electricity in a reliable and efficient manner. It should also be commercially available and can be easily maintained and repaired on site.

(v) A major concern in the selection of energy end-use equipment is to select the equipment that can help reducing the tourist facility energy consumption and upgrade energy use efficiency while still maintaining top-level service.

(vi) Encourage the use of centralized electrical supply systems for a group of remote tourist villages to levelize the load demand over time and upgrade system efficiency.

2. Energy systems design approach

In the process of developing a new tourist facility, the design of the energy systems is a primary element. The following discussion provides information on important factors that must be considered during the design process, this will allow the design team to use a consistent design philosophy, simplifying much of the coordination that is required among team members. The factors to be considered include:

(a) *Reducing energy peak loads*

Many of the more costly energy systems required for tourist facilities, particularly the power generation system and the air conditioning system, must be sized to meet the relevant peak loads, which is much higher than the size of the average loads. As a result a good part of the installed capacity may sit idle for a large portion of the time. Therefore, the overall design of the tourist facility should be arranged to reduce peak load requirements, which will reap substantial benefits in reduced system capital cost. Peak loads can be achieved through the use of:

(i) Energy Management Systems (EMS) to prevent simultaneous restarts and cycle equipment on and off, as to prevent any overload.

(ii) Solar Water Heating (SWH) and photovoltaic/battery pole lights for small lighting loads.

(iii) A number of smaller diesel generators, instead of one large unit, so that they can operate near their full rated power for better operating efficiency during periods of low load demand.

(b) *Upgrading energy use efficiency*

During the design and construction stage, the design team and relevant stakeholders should focus on the energy performance requirements of the hotel. Energy savings options at this stage would include:

(i) Grouping a number of smaller modular power units to closely match the energy supply to the load demand, secure availability of supply and simplify system expansion if required.

(ii) Building envelope components such as doors and windows, insulation, and roofing, that can help reducing the energy demand for HVAC and lighting.

(iii) Hotel fittings that are proven to be energy efficient and economically feasible. These can include, guest digital thermostat, compact fluorescent table lamps, occupancy sensor, efficient motors, etc.

(c) *Integrating renewable energy, as appropriate*

Renewable energy can contribute effectively to the energy mix in tourist facilities through two main applications: (1) Water heating which can prove to be technically and economically viable in all locations and (2) Power generation systems, where the use of renewable energy will increase up-front capital expenditures, but the fact that no fuel is required and that maintenance can be low may make the overall cost of power, over the system lifetime, less than that from fossil-fueled alternatives. A decision to use renewable power sources must be made very carefully. Generally, back-up power generation and/or storage systems will be required to ensure a reliable source of power on demand. The effective cost of renewable power systems use is application specific, but the possibility for reduced energy cost makes it an option worthy of careful consideration.

(d) *Evaluating competing options*

Tradeoffs between two or more systems able to perform the same function must often be considered in the design process. The designer must analyze technically, economically and environmentally the advantages and disadvantages of the two systems in light of the specific requirements at the site. Characteristics of the competing design options such as capital and operating costs, environmental impact, energy requirements, reliability, redundancy requirements, availability of qualified maintenance personnel, availability of spare parts, and expected system life must be reviewed. Care must be taken in performing the analysis to be certain that all aspects are being correctly analyzed.(4)

(e) *Iterating the design process*

In general, the design process is iterative in nature. That is, once conceptual subsystem designs have been developed, all design elements will be reviewed "as a whole" to gauge their impacts on one another. The original design would then be iterated and re-worked with this modification in mind, until a fully integrated design was developed.

B. RECOMMENDED DESIGN MEASURES AND SYSTEM OPTIONS

The primary function of this section is to familiarize the reader with key design measures and technology options that are appropriate for use in designing energy systems for different end-use applications in tourist facilities.

1. Design measures

In light of the energy systems design strategy and approach discussed earlier in this chapter, there are additional number of key design measures that, the design team has to consider carefully prior to the selection of the energy system options to be used for the tourist facility, these include:

(a) In line with the "whole building design" approach set by the strategy, two measures has to be adopted at the inception of the design phase and be revised periodically throughout the design and construction processes. These are:

- (i) The building design should include, as appropriate, passive heating and cooling elements.
- (ii) HVAC system design should consider all interrelated building elements, while addressing indoor air quality, energy consumption and environmental benefits.

(b) Energy equipment should be appropriately selected and sized, based on an accurate assessment of the specific energy needs for the tourist facility. This would include:

- (i) The final electrical system selection and sizing must consider the following factors with respect to the tourist village load demand: the average and maximum (peak) load, the load profile (seasonal and hourly variations), and the daily load priorities and time sensitivity.
- (ii) Peak loads should be accurately evaluated, taking into account the possible use of renewable energy, more efficient systems, etc. that would reduce both the base and peak loads of the conventional energy systems.

(c) At the initial design phase, the use of the most efficient and advanced market available energy technologies and system have to be considered both for energy production and end use systems. These options should be evaluated and optimized based on its availability, cost and environmental benefits.

(d) At the final design stages it is essential to develop and implement a well thought-out commissioning processes and periodical preventive maintenance program for all selected energy equipment and systems.

2. Recommended system options

Technology advances and engineering practices during the previous years have made energy producing and consuming technologies commercially available with higher efficiency and reliability. Many of these technologies can be used to supply energy services to the tourism sector. As well, some retrofit energy equipment and control fittings can help upgrading the efficiency of existing equipment (i.e. cogeneration, power cut-off cards, etc.).

The primary determination of which options are appropriate is basically based on three factors: the economic size for a given option, the commercial readiness of the technology, and its environmental impacts and/or benefits which started currently to be considered to ensure guest satisfaction.

Annex II presents a brief description of two sets of technologies that are recommended for use in tourist facilities and explains the measures to upgrade its energy efficiency. [(18)] The first set includes three electric and thermal energy producing technologies namely; steam production systems, hot water production systems and cogeneration system. The second are efficient energy end-use technologies for applications on lighting, HVAC, kitchen and laundry equipments and electric load management.

In addition, while tables 9 and 10, in Chapter II include summaries of the technology options for electrical and thermal energy supplies to tourist facilities, table 13 summarizes the building climate control, steam generation and general services technology options advantages and disadvantages. In addition it provides comments on potential reliable applications of each technology in tourist facilities. The emphasis here is on systems, which are common to most tourist facilities.

Meanwhile, table 14 presents a summary of the recommended energy systems options for tourism facilities. The table is therefore divided into three sections, those that <u>should</u> always be incorporated into the tourist facility design, those that are <u>usually</u> used, and those that should be <u>considered</u> and evaluated.

C. ENERGY SYSTEM MANAGEMENT

In response to the recommendations of the global conferences on tourism and sustainable development regarding the need for promoting eco-tourism, many hotels and managerial chains are showing interest in reducing the environmental impacts associated with the business operation. Meanwhile, it is in the core interest of the tourist facilities management to upgrade the energy use efficiencies within the facility to reduce both costs and environmental impacts, which can improve the business public image.

The previous sections of this chapter presented the energy systems design approach and recommended a set of measures and energy technologies for use in the tourism facilities being established or renovated. Therefore, this section discusses the required actions for energy management in the operating tourist facilities. These actions are intended to enhance opportunities for upgrading energy efficiency, reducing costs and environmental impacts without compromising the guests' comfort. The main energy management activities are mainly directed towards, energy audits, energy efficiency improvement as well as enhancing awareness and participation of the tourist facilities staff, management and guests.

TABLE 13. SUMMARY OF BUILDING CLIMATE CONTROL, STEAM GENERATION AND GENERAL SERVICE TECHNOLOGY OPTIONS *

Technology	Advantages	Disadvantages	Comments
Passive Building Design Heating / Cooling	• Makes use of traditional architecture. • Reduce HVAC energy loads.	• May limit some architectural design options. • Effect of Passive cooling designs may be limited to.	• Passive designs produce compelling benefits in both design and operation, it is highly recommended to be used throughout tourist villages.
Energy Efficient Steam Generators	• Include, improving boiler efficiency, appropriate O&M program, condensate return systems, vapor traps and insulation. • Can improve system efficiency by 25-35 % • Most measures are of low-cost.	• Waste heat recovery systems are expensive, however, payback in 2-3 years.	• Low cost items should be used and capital investment item be evaluated.
Energy Management and Control System (EMCS)	• Automatically controls energy producing and consuming equipment. • Effectively reduce peak loads.	• Complex EMCS systems are primary consumers of electricity, they need to be carefully evaluated.	• A simple, easily maintained EMCS is recommended for every tourist facility. • A more complex EMCS may not be useful for all applications.
Efficient Lighting appliances	• 4-5 times more efficient than incandescent lamps. • Last over 10 years lifetime. • Payback during 6-18 months.	• Higher initial cost.	• Should be used all over the tourist facility.
Conventional Cooling Systems	• Equipment is widely available. • Operation and maintenance personnel are available.	• Conventional cooling system are a primary consumer of electricity at a tourist facility.	• While some conventional cooling equipment will certainly be required, passive cooling options should be considered first to minimize cooling loads.
Occupancy Sensors and Key-Card systems.	• Effectively limits guest room energy and water consumption by 15-20 percent. • Reduce peak loads by 5-10 percent.		• Occupancy sensor, key card systems should be considered for tourist facilities.
Energy/ Water Conservation Packages for the Kitchen and laundry	• Reduces laundry and kitchen energy and water consumption up to 80.0 percent.	• System capital cost must be recouped through energy and water savings.	• Considering the scarcity of water, and the cost of electricity self-generation, this equipment should be considered standard for remote tourist villages.

* Systems not given in the table are given in tables 9 & 10 in Chapter II.

TABLE 14. SUMMARY OF THE RECOMMENDED ENERGY SYSTEM OPTIONS FOR TOURISM FACILITIES

Tourist facility designers should be encouraged to:		
Always use these options	Usually use these options	Consider these options
A. For electricity supply and use system		
• High efficiency diesel engine. • Energy Management and Control System (EMCS). • High efficiency motors, pumps, compressors, air handlers, etc. • High efficiency appliances. • High efficiency lighting for indoors (fluorescents) and outdoors (High Intensity Discharge – HID).	• Waste heat recovery (cogeneration) system. • Renewable energy/diesel hybrid power supply system. • Area lighting as opposed to general lighting. • Reduced lighting in hallways and other less used areas. • Natural lighting where it is sufficient.	• Standalone photovoltaic power system for remote application. • Standalone wind power system for remote tourist applications. • Automatic light sensors where lighting needs are infrequent.
B. For thermal energy systems		
• More efficient, advanced types of boilers. • Hot water storage. • Insulation on hot and cold pipes as well as thermal storage. • Low-flow plumbing fixtures for showers and faucets.	• Waste heat recovery (cogeneration) system. • Solar water heating	
C. For building climate control and general services		
• Passive features wherever possible. • Building thermal insulation. • EMCS.	• Energy & water conservation kitchen equipment (pressure steamer, low temperature dishwashers, etc.) • Energy & water conservation laundry Equipment. (heat recovery system, insulation..) • Occupancy sensors or key-cards.	• Evaporative cooling.

1. The energy audit

A major step for promoting eco-tourism and implementing green policies in tourist facilities is to conduct environmental audit that assist stakeholders to plan the project appropriately before embarking on it. Among the basic types of environmental audits are: compliance audits, waste audits, environmental management audit, environmental liability definition, and the energy audit.[30] The following is a brief on the objectives, benefits and stages of the required energy audit for tourist facilities.

(a) *Objectives and benefits*

The energy audit is an essential step toward the establishment of a professional energy-management program within the hotel establishment. It can be designed and performed separately, or preferably as an integral part of the environmental audits in hotels. The auditing process is a systematic, detailed, and periodic process, usually carried out by or under the supervision of an experienced consultant, with the core objective of identifying feasible options for upgrading energy efficiency in hotel facilities and reducing energy cost. This would include the following actions:

- To identify the types, sources, and costs of energy used in hotels.
- To understand how energy is being used - and possibly wasted
- To assess compliance with government legislation, regulations, guidelines, codes of practice, and permit conditions.
- To assess adherence to internal policies and procedures.
- To assess current energy management practices status.
- To identify and analyze potential energy conservation opportunities.
- To perform comparative economic analysis on available energy conservation alternatives and determine the most cost effective options.

Conducting energy audits in hotels would lead for more efficient energy consumption, reduce energy expenditures and reduce negative environmental impacts, thus improving the hotel's image, enhancing its competitiveness. It also facilitates the certification of hotel energy processes by concerned authorities, which will improve productivity and safety awareness and trigger new priorities and practises.

(b) *Stages of implementation*

The energy audit is usually performed in stages, including: (a) data collection and analysis; (b) field surveys; (3) implementation; (4) monitoring and follow-up on audit results. A description of each stage relevant to an existing tourist facility is given in Annex III.

At the end of the audit process, an audit report is produced including detailed sections relevant to each of the objectives identified above. The report will also include summary of the identified feasible and proposed practical actions classified to three priorities according to its cost. These are: no cost (mostly maintenance and management); low cost (improvements of equipment) and medium to high cost (technology packages) are identified. Finally, an action plan with rough budget will be recommended.

Meanwhile, since an energy management programme based on the audit results has to continue for a long time (ideally throughout the lifetime of the building), one person should be made responsible for energy management, an energy manager, and be released from other duties, either partly or completely. An effective energy manager must be adequately trained for the purpose. He/she should possess a number of skill, such as: computer abilities; an understanding of building energy systems; familiarity with utility data and tariff structures; building energy survey skills, etc. Also, a positive attitude from top management towards energy management programmes is also vital before such programmes can be started or carried out.

In an effort to unify the environmental auditing procedures and methods in hotels, conducted by the private sector in Lebanon, the Lebanese Ministry of the Environment has designed a detailed audit manual covering seven main aspects of environmental issues in hotels, namely: environmental management practices; water consumption; wastewater generation; air quality and gaseous emissions; solid waste generation; energy consumption; and safety. Annex IV presents with slight modifications the two energy relevant checklists included in the manual concerning: (1) energy consumption, and (2) air quality and gaseous emissions.[30]

2. Energy efficiency improvement

With rising energy costs, energy conservation has become very important within the tourism sector, particularly in relation to the hotel industry, which uses substantial amount of energy towards providing comfort and services to its guests. Energy conservation provides hotel managers with considerable opportunities to reduce operation costs and improve the services offered.

Energy saving measures in tourist facilities includes improving the efficiency of energy systems and equipments (technology options), described earlier in section B of this chapter, as well as improving the energy management practices (management options); however, effective energy management plan cannot begin until a thorough energy audit has been conducted and priority options for improving energy efficiency are identified.[18]

Studies have shown that most hotels use energy inefficiently. Real savings can be made through improvements ranging from no cost measures such as proper adjustment of temperature controls and shutting of equipment when it is not in use, to 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 combine energy improvements with conservation of other resource. For example, low-flow showerheads reduce both water use and also energy use because less energy is needed to heat the water.

The following provides a brief explanation of possible energy management option at the different zones of a tourist facility, where the concerned staff and application in each zone can be trained on such energy management options and contribute effectively its implementation [30]. Specific guidelines are given in Chapter V on how to upgrade energy use efficiency in the major energy consuming applications in the tourist facility namely HVAC, lighting, water heaters and general services. It also presents guidelines for the facility staff and managers on how to use energy efficient use in the different zones of the facilities.

(a) *Guest rooms*

(i) *Front office personnel*

Energy management can starts in front office even before guests arrive. A room assignment plan can reduce energy consumption connected with space conditioning significantly. When assigning rooms, make sure that guests are assigned to adjoining rooms so that the heating or cooling of occupied rooms acts as a buffer or insulator. Heating and cooling systems in unoccupied rooms or areas can be turned off (except in extreme weather conditions) or thermostats set at energy efficient consumption levels (83-85 degrees in summer and 50-55 degrees in winter). In hotels/motels using individual room HVAC units, a recently developed control system (could be used to turn these units on and off from the front desk when guest rooms are vacant.

(ii) *Housekeeping*

Well-informed housekeepers can assist greatly in saving energy through good housekeeping procedures. Some examples include, 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).

(b) *Public areas and services*

Public areas in hotels (lobby, meeting rooms, offices, shops, bars, lounges, etc) can contribute substantially to total energy requirements. Unlike guest rooms their energy consumption control is much easier. Possible energy-savings opportunities are listed below.

(i) *Space conditioning*

Some good examples may include 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. Or, considering installing an energy management system to control the HVAC system. Set the thermostat at night in unoccupied spaces between 78-85 degrees Fahrenheit during cooling season and between 55-65 degrees during heating season. Consider the use of ceiling fans in appropriate public areas (lobby, lounge, dining room). Regularly clean and service the boilers, chillers, condenser coils, and air filters of the space conditioning equipment that provides heating and cooling to public areas. Consider the use of solar screens, window film or awnings over large areas of glass, such as in the lobby or dining room.

(ii) *Lighting*

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. Several additional practices also include making use of natural light by opening draperies and raising shades while setting up or tearing down function rooms. Where appropriate, to consider the installation of solid-state dimmer switches, which can reduce energy consumption.

(c) *Maintenance department*

Maintenance can significantly affect the efficiency of equipment. Some tips for proper maintenance of the heating, ventilating and air conditioning (HVAC) system -the largest user of energy in hotels and motels--and for other equipment includes checking and cleaning HVAC filters, condenser and evaporator coils, sealing cracks around windows, doors, and wall/ window type HVAC units.

(d) *Swimming pools and spas*

Swimming pools and spas require a great deal of energy. Unfortunately, many of the energy-using systems that support swimming pools and spas cannot be substantially altered without adversely affecting their operation. For example, a pool's water filtration system uses electricity almost continuously. It cannot be stopped, however, because the water would quickly become dirty and create a possible health hazard.

The following actions can conserve energy in swimming pool and spa operations: (1) follow manufacturer's preventive maintenance program for heaters to prevent scaling/-soothing; (2) install timers on pool and spa heaters so that they are not left on after pool hours; (3) operate spa and pool heaters only during times of usage; (4) allow for a short warm-up time just before use; (5) keep pool thermostats at 80-82 degrees or lower, and spa thermostats at 95 -100 degrees, and (6) consider sheltering outdoor pools and spas from prevailing winds with hedges, fencing or other windbreaks.

(d) *Ice-makers and vending machines*

The icemakers and vending machines operate continuously and consequently consume electricity 8,760 hours a year. Two actions are recommended to upgrade energy use efficiency in these facilities: (1) regularly clean and check condenser coils on your icemakers and vending machines; and (2) have the firm that installs and supplies the vending machines perform maintenance on their equipment (e.g., routinely check refrigerant levels).

3. Enhancing awareness and participation on energy management

Education and training are integral components of effective environmental management of isolated resort facilities. The owner / operator's commitment to environmental protection must be clear and explicit.

As part of the energy management programme, and as an efficient and cost-effective way to reduce energy use in tourist facilities is to involve personnel. The participation of all the facility employees, manager and guests, in implementing the energy management program is considered essential for the program success. This is done through informing the employees, first, of the initial steps of program implementation, the success that were accomplished, and the failures, if present, with their causes and lessons learned. As well it is critical to ensure that the systems within a new or renovated hotel will be performing according to the design criteria and contract documents. Training of hotel staff and personnel is a key issue in operation and maintenance stage. Savings from personnel involvement are, somewhat simplified, dependent on two issues; motivation and information.[--]

The type of information that should be made available varies throughout an energy management programme. Clear and understandable information is generally needed in the introductory phase. Simply informing personnel about how to save energy and how much can be saved will make them interested in taking part. It might be beneficial to educate key staff, such as service and maintenance personnel, etc., thus increasing understanding of energy conservation measures. It is most important that all personnel are involved in some way, from top management down.

Informing personnel can be achieved through the staff rotary meetings, flyers and bulletin boards in the facility, or through using the Internet if possible. It is also necessary to initiate an incentive system that encourages employees to do all what they possibly can to improve energy efficiency, this can be achieved through participating in simple activities that reveal high awareness in the importance of regulating energy consumption between the employees. Prizes for competitions, done for this purpose, between the different administrations in the facility, as assigned. A program which rewards employees for environmental maintenance will go a long way towards setting the proper conditions for successful education and training efforts.

There is normally no problem with personnel motivation if information about a programme is presented at an early stage. Problems can arise later if personnel are not continuously informed of the results of their efforts. By giving adequate feedback, motivation can be maintained. Staff can be kept informed in several ways. A simple way to spread information about progress achieved in upgrading energy efficiency is with regular information leaflets or newsletters showing how much energy was used in each facility section compared to earlier periods. These can be used to introduce an element of competition between different sections of the hotel, or for hotel chains, between different locations. This might be seen by staff as an incentive to increase their efforts to save energy.

It is also important to make a simple arrangement to acquaint the facility guests and inform them of the energy management program being implemented, asking them to participate in the implementation of this program through carrying out simple action that are presented in posters and flyers available throughout the facility.

It is to be mentioned that, as the awareness level of the guests regarding the importance of energy regulation and protecting the environment, grows rapidly on the international level, the implementation of such simple recommendations has become easy to do.

IV. EFFICIENT ENERGY MANAGEMENT IN TOURISM: EXPERIENCES OF SELECTED ESCWA MEMBER COUNTRIES

The tourism sector is considered to be one of the fastest growing sectors in the ESCWA region. The revenues from its activities have gradually become an important part of some countries GDP such as in Egypt, Jordan, and Lebanon, with a promising potential of expansion in the future. This fact has lead to a potential in hotel developments throughout the region, both in destinations that focus on vocational consumers, such as the Red Sea and Sinai resorts, and in the more cosmopolitan destination such as Dubai and Cairo that are able to attract both vocational and commercial visitors. Some relevant policies and measures were also developed by several member countries to support the promotion of the sector. With the expected growth in hotels/ resort areas in the region and the relevant demand for resources, particularly energy; measures that vocationally support the sustainability of the sector and minimize its negative impacts are considered imperative, however few countries have adopted measures to encourage the sustainability of the sector.

The previous chapters of this report have shed lights on the importance of promoting Sustainable Tourism Development (STD) and discussed the relevance of energy to STD, and provided information on the different energy issues relevant to the development of tourist facilities in general and options for the efficient use of energy within the sector, in particular. To reflect the nature of the tourism development in the region and the efforts directing towards improving energy management in it, this chapter presents two experiences from within the region. The first is the case of Egypt, which has a long time experience in different types of tourism and tremendously developed its coastal tourist facilities during the last two decades; as well Egypt has a reasonable experience in energy management in tourist facilities. The second is the case of Lebanon, which is a desirable destination for both commercial and vocational purposes and has developed a remarkable experience particularly for the hotel and restaurant sector.

A. ENERGY MANAGEMENT IN THE TOURISM SECTOR OF EGYPT [1]

The tourism sector in Egypt is well established. As a result, a wide range of information and data is available on all aspects related to the sector. However, the next section attempts to give only a brief overview of Egypt tourism sector particularly the hotel sector and present briefly the relevant energy management experience.

1. Tourism in Egypt - a brief overview (18)

Egypt enjoys many aspects of the tourism attraction. In addition to its all year round moderate temperature, geographic location amidst international markets, its unique tourist sites that go back in history for over 5000, its coastline beaches that stretch for 2400 Km along the red sea and Mediterranean cost, place it in the top list of the most attractive destination for tourists.

The tourism industry has traditionally centered in Cairo, Luxor, Aswan and the Nile valley. Egypt has other areas with diverse natural resources that appeal to tourist including the Sinai and Red Sea cost where both areas were declared by the Egyptian Ministry of Tourism as high priority areas for costal tourism development. However, due to their unique and critical environmental nature, their careful protection is imperative and is a deriving concern for any regional development. A typical modular tourist village characteristic in these areas is given in table 15. A tourist village may consist of one or more of these plots.

Over the past two decades, the tourism industry in Egypt has become an essential pillar in Egyptian economic activity. In 2000/2001 it contributed 1.8% to the Gross domestic product (GDP). It also contributed to the employment of 155, 000 workers (0.9 % of total work force). Moreover, the tourism sector contributed 5.1% (4.25 million pounds) of the total investments in Egypt in that period. Tourism revenues represents 43.6% of total export services.

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[1] Information given in this section draws mainly from Ibrahim Abdel Galil , “Improving Energy Efficiency in the Tourism Sector: case study of Egypt. Consulting Report to ESCWA, May 2003.

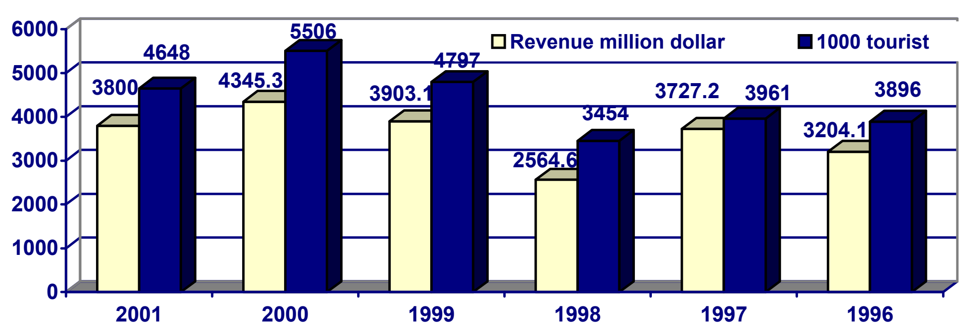
TABLE 15. A TYPICAL MODULAR TOURIST VILLAGE CHARACTERISTICS IN RED SEA AREA[(4)]

Geographic Location:	Red Sea or South Sinai Governorate
Area:	500 meter beach front, 200 meters deep
Aquatic Features:	Sand or pebble beach, fringing coral reef
Number of gust unit:	100-250
Number of gust per uni;	2
Occupancy:	70 – 90 percent
Staffing Requirements:	1.25 staff members/guest room
Amenity Level:	3 – 5 stars
On-site Services:	Resultant, laundry, shops (basic), and Swimming pool, game room, boat cruises, business center (optional)
Locally Available Water:	Seawater, brackish wells
Water Supplies:	Desalinated water (produced either on-site, truck delivery, or municipal pipeline)
Power Supply:	Electricity produced on-site, or from local grid.
Sewage Treatment:	Municipal facilities only available at scattered sites
Solid Waste Disposal:	Municipal facilities only available at scattered sites

Source: New and Renewable Energy Authority (NREA), Egypt and USAID, "A Guide for Preliminary Planning and Assessment of Energy Efficient and Environmentally Sound Tourist Villages in Remote Areas of the Sea Cost of Egypt", 1991.

Figure V represents the development of tourist numbers and revenues in Egypt during (1996-2001). The number of visitors peaked in 2000 (5.5 million visitor), which had positively reflected on the room occupancy for that year, estimated to be 32,8 million tourist night, where the average expenditure was US$ 125 per tourist per night.

Figure V. Development of number of tourists and tourism revenues in Egypt (1996-2001)



Source: Ibrahim Abdel Galil, "Improving Energy Efficiency in the Tourism Sector: case study of Egypt. Consulting Report to ESCWA, May 2003.

The years 1996-2001 witnessed a remarkable growth in the number of hotel rooms available, especially in the Red Sea and south Sinai areas. The increase was 61% at an annual growth rate of 15%. South Sinai area enjoyed 69.3% increase on a yearly average followed by the Red Sea costal region 36% on a yearly average. New hotels are under construction in different tourism development areas in Egypt. According to plan, 114087 rooms are under construction. When these projects are completed the hotel capacity will be around 228,000 rooms, mainly in South Sinai and the Red Sea areas. Five stars and four stars hotels represent 56.6 % of total capacity.

The fifth-five year plan for economic and social development (2002 -2007) in Egypt aims to accomplish a number of goals, including: (a) Limit the quick growth of lodging capacity in the tourism development in existing locations, which at present absorb most of the tourists in Egypt (i.e. Greater Cairo and Alexandria), and raise the quality of the tourism services; (b) Intensify the development of other active and unique tourist areas such as Luxor, Aswan, Ghardaga, Red Sea Coast, and Sharm Al Sheikh; (c) Develop the promising areas privileged with attractions such as Ein Sokhneh, Saint Catherine and Ras Sedr. In view of that, tourist village development is expected to exceed the traditional hotels. Moreover, number of nights is expected to increase from 24 (in 2002) to 41,5 (in 2007) at an average annual growth rate of 11.6 with a target of 5 billion dollars in revenues and 150,000-hotel room capacity.

2. Energy consumption patterns in the Egyptian tourism sector

Electrical energy needed in tourism establishment in Egypt is extended either through the Unified Electricity Network particularly for establishments located in large towns like Cairo, Alexandria, Port Said or through Small diesel-power stations especially in areas where the unified network lines do not reach or where connection to the network is costly, particularly in Red Sea and South of Sinai areas.

Heat Energy for hot water production can be supplied through using electric water heaters but this is a costly alternative. Some studies indicate that the cost of producing one cubic meter of hot water using electricity, in the Red Sea region, is estimated to be about 8.4 Egyptian pounds (LE) compared to 1.6 LE in case of using a diesel commercial boiler. Central heating units for producing hot water that work on diesel fuel, natural gas, or electricity are also used. Since diesel fuel in Egypt is subsidized, it is the most widespread in operating water boilers in most hotels and tourism villages.

Most tourism establishments use natural gas in cooking if located in areas where natural gas is available. As for those located far from such areas, butane gas is used, where it is transported in cylinders from its production site to those needy areas.

Attempts to define energy consumption and pattern of use in hotels in several governorate were made by several fields' studies. In the governorate of Cairo, the result of a study on two hotels categories: (1-3 stars) and (4-5 stars) indicated the differences in energy consumption pattern between the two hotels category. HVAC and lighting were found to be the biggest energy use sources in four and five stars hotels (about 39 % each of total consumption). In lower category hotels, lighting represents only 28% of the total consumption followed by kitchen and food preparation consumption (27%) while HVAC consumption was 20% of total energy consumption.

In terms of energy consumption**,** the results of the same study indicated that the average specific electricity consumption in hotels of the first category (1-3 stars) is 110.6 kWh/year/m^2 compared to 196.8 kWh/year/m^2 in hotels of the second category (4-5) corresponding to 1.8 times the consumption of the first category.

In a similar study conducted in the governorate of Suez, the monthly average electricity consumption of a hotel room in (1-3 stars) ranges between 173.2 kWh in winter to 182.3 kWh in summer. Another study conducted in Post said governorate for the same hotel category, indicated that the average specific monthly consumption per room ranges between 54.4 kWh in summer, to 70.3 kWh in winter. It also showed that the biggest amount of electric energy used in summer is for air-conditioning purposes, while lighting consumed the biggest amount in winter.

In the Giza governorate, an energy audit conducted in Hotel Europe (4 stars) revealed that water heating consumed 44%, while 26% was consumed for air-conditioning and cooling purposes. The same study revealed that guest rooms are the highest consuming centers within the hotel, consuming 58% for both cooling and air-conditioning and 42% for lighting and 60% of the total energy used for heating water. This study also showed that the average monthly room consumption in a hotel is around 677 kWh. The hotel energy supplies come from diesel 58% used for heating water, electricity 39% as well as 3% from gas for cooking.

In a study carried out on hotel Samiramis Intercontinental (5 stars) in Cairo, the average hotel room consumption was found to be around 1852 kWh monthly, while its natural gas consumption is around 5.4 m^3 per month[2]. It is to be mentioned here that the total consumption of energy is related to the occupancy rates at the hotel, which vary from one season to another. Some months are known as peak season such as the winter months of the Red sea and South Sinai areas. However there is a minimum amount of energy consumption known as basic load, which is consumed by a hotel whatever the occupancy rate is even if it is zero to operate some facilities and public services (lighting for hallways, receptions, offices etc). Whenever the occupancy rate increases in the hotel, for example, a study carried out in the Red sea area indicated that the amount of the basic load in a tourist establishment consisting of 70 hotel rooms was 250990 kWh/month. Each guest increases the hotel energy consumption by 13.7 kWh/day on top of the basic load amount.

3. Status of achieved energy efficiency improvements

In general, studies on energy use in tourist establishments in Egypt have identified specific areas that require improvements and achieved these improvements through adopting several energy management practices and/or enhancing the energy systems efficiency. Some of the improvements applied to the intensive energy consuming systems are briefly described below.

(a) *Lighting*

Tourist establishments lighting systems in Egypt are inferior to the lever required, this is due to the abuse of these systems, which leads to the increase in lighting intensity above the common level in some areas or decrease of lighting intensity below the common level in other areas. In addition, a lot of hotels in Egypt are still using some of the low efficiency lighting.

Lately, some tourist establishments and especially the ones located in newly set up areas, such as the Red Sea coast and South Sinai, have started to use some of the electric energy lighting rationalization technologies, for example: highly efficient light bulbs, fluorescent light bulbs and also key cards, which allow room lighting only when the guest room is occupied.

(b) *Air Conditioning*

Two air conditioning systems are used within hotel establishments in Egypt. Hotels located in big cities such as Cairo, Alexandria and Aswan, etc. use central air conditioning. While tourist villages located in tourist developing areas on the Red Sea coast and Gulf of Aqaba use mainly split-units air conditioning systems, installed in each guest room, dining room, etc.

Studies concerning central air conditioning points out the low control level of these systems due to the lack of efficient maintenance, leading to an increase in the consumption of electric energy in order to provide air conditioning to areas that may be unoccupied during night or day time. Air leak in some air-conditioned areas leads to a loss of part of the cooled air. Carelessness, such as leaving doors of conditioned spaces open (dining halls, shops, banquet halls, etc.) also results in energy loss.

Some tourist establishments have started to install keycards, mentioned previously, which allow the air conditioning units to work only when the room is occupied.

In Egypt, locally manufactured equipment is low in efficiency, as there are no standard specifications to insure the minimum energy efficiency in this equipment. Lately, specifications have been applied to air conditioning units and refrigerators, as the first issue of Egyptian standard specifications for energy efficiency was effective as of 1 April 2003 [(18)].

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[2] These figures are calculated based on the total average electricity and natural gas monthly consumption divided by total number of room (850 rooms) and includes share of each room of public services and facilities consumption.

(c) *Cooking Equipment*

Kitchens are considered one of the highest energy consumption centers in hotels and tourist villages, due to their energy consuming equipment such as electric cooking ovens (16.2% of the total electricity consumption in Hotel Europe at Giza governorate) and gas ovens in addition to (cookers) ovens that consume natural gas, butane or electricity, also refrigerators and deep freezers, dishwashers and water heaters and other small electric apparatuses used for food preparation.

4. Energy efficiency improvements in selected Egyptian tourist facilities

A number of projects were implemented in several hotels and tourist villages with the aim of improving their energy efficiency. Included in these projects, enhancement of lighting efficiency systems in hotel Europe (a 4-star hotel in Giza Goveornate): Use of keycards in guest rooms at Shadwan tourist village located in Hurghada on Red Sea coast: Electric capacity plant enhancement at the Meridian Pyramids hotel (a 5-star hotel at Giza Goveornate): Heat loss retrieve system in a Red Sea tourist village: heat loss recovery from the diesel engine exhaust for vapor and hot water production. The following is a brief outline on these projects including cost / revenue statements.

(a) *Improving the lighting efficiency systems in Hotel Europe (a 4-star hotel in Giza Goveornate)*

An energy audit in the hotel revealed the massive use of ordinary light bulbs (incandescent) in the reception hall, restaurant, cafeteria, banquet hall, etc. The study recommends exchanging the 60-watt ordinary light bulbs with its equivalent of highly efficient light bulbs (16 watt capacity), also exchanging the 40-watt ordinary light bulbs with its equivalent of highly efficient fluorescent light bulbs (9 watt capacity). The results were the following:

Expected energy saving	167,566 kilowatt hour / year
Expected value of energy saving	41,891 Egyptian pound / year
Required investment	50,064 Egyptian pound
Payback period	1.2 years

(b) *Use of keycards in guest rooms at Shadwan tourist village located in Hurghada on Red Sea coast*

The Shadwan village consists of 16 detached buildings spread throughout a vast area; each building has 206 rooms in total. Split air conditioning units are used in each room, except for three buildings air conditioned by central units. Energy consumption of air conditioning units in rooms depends on their occupancy rate, therefore, the energy audit team highly recommended the installation of air conditioning controls in guest rooms, which allows the air conditioning electric current to be disconnected whenever the guest leaves the room. Keycards have been installed in 24 rooms for experimentation and the results of energy saving value have been measured as follows:

Energy consumption saving	31,000 kilowatt hour / year
Energy consumption saving value	6,800 Egyptian pound / year
Investments	3,600 Egyptian pound
Payback period	6 months

C. *Electric capacity plant enhancement at the Meridian Pyramids hotel (a 5-star hotel at Giza Goveornate)*

Due to the reactive loads of motors used in different aspects of the hotel, field measurements showed the decrease of electric power factor to 0.865, meaning that the hotel is continuously under levy as the electric power factor is less than 0.9 according to the system of the holding company of electricity in Egypt. To overcome this problem, a number of intensifiers and related controllers to increase the power factor to more than 0.9 were installed. This arrangement will help in any possible future increase in the loads:

Yearly savings	31,000 Egyptian pound
Investments	99,527 Egyptian pound
Payback period	3 years

(d) *Heat loss recovery in the Torba village in the Red Sea area*

The village has 150 hotel rooms supplied by self-generated electricity using 3 diesel generators. Two boilers located in the same building with the electric generators produce hot water. A detailed study has proved that the installation of a heat loss recovery unit for the diesel generator is an alternative to the present boilers, where the heat generated can be used to produce enough hot water for the whole village. The results are:

Yearly savings	35,000 Egyptian pound
Investments	100,000 Egyptian pound
Payback period	3 years

(e) *Cogeneration in the Oriental village in Sharm El Sheik*

A 5-star located in south Sinaii area with 278 rooms, suites and hotel villas is supplied with electricity by 5 diesel generators with a total capacity of 4 MVA. Two MVA of such capacity supply the basic load, while the other generators operate during peak time. The maximum village electricity load is 800 kilowatt and the thermal load is estimated around 148 kilowatt. The use of multi-unit generating system helps upgrading efficiency.

A study concerning recovering the heat loss from the main load diesel units was carried out, based on which it was recommended to use the recovered heat from the diesel generators exhaust to produce vapor and hot water enough for the village needs. The results are:

Savings in diesel fuel consumption	220 ton / year
Diesel consumption saving value	88,000 pound / year
O&M saving value	18,319 pound / year
Total amount of savings	106,319 pound / year
Total investments	415,000 pound
Payback period	3.9 years

5. Barriers to energy efficiency improvement in the tourism sector in Egypt

The spread out of technology use and energy management measures in Egypt in general and in the tourism sector in particular faces some obstacles, which must be eliminated through adoption of long-term policies and relevant strategies. The main obstacles include:

(a) *Lack or weak legislations*

There is lack of legislation relevant to energy management and standard specifications for energy efficiency in buildings or energy consuming equipment widely spread in tourism sector such as air conditioning units, motors, washing machines, cooking ovens, etc. Lack of legislation results in a voluntary energy use improvements and also subject it to the market force. As the energy markets in Egypt are not yet fully liberalized and still under control of the government, it is difficult to convince and encourage tourist establishments to enhance their efficiency if there are no economic reasons behind that.

(b) *Energy pricing policies*

It is well known that the price of all different types of energy (petroleum products, natural gas, electricity) in Egypt is much less than the real cost due to the government subsidy aiming at the protection of the lower social class. The amount of subsidy for different energy products in Egypt was around 14.5 billion pounds in the year 2002, which is equal to 15% of the total government expenditure.

The unreal prices of energy products have played a major role in decreasing the energy efficiency level of various consumption sectors including the tourism sector. These prices have a negative effect on the economies of energy efficiency projects and are one of the main obstacles limiting the spread out of highly efficient technologies.

(c) *Devaluation of the Egyptian currency*

The Egyptian pound has been devalued by 77% from January 2000 till May 2003. The exchange rate of the Egyptian pound was 1 U.S. dollar per 3.4 Egyptian pounds compared to 6 pounds in the meantime, which lead to a considerable increase in the cost of energy rationalization projects due to value of imported equipment, which is the highest part of the cost and should be paid in hard currency. Therefore, decreasing the economies of efficiency enhancement projects decreases the competency of the investment in this domain compared to other domains that seek mainly to increase the competency of the tourism sector.

(d) *Lack of financing systems*

Energy efficiency markets in Egypt in general are undergoing problems of lack of necessary funds, except for some funds provided by a few commercial banks characterized by high interest rates which represent a considerable burden added to the cost of efficiency enhancement projects. The high investment cost of energy efficiency projects enforces the tourist establishments to use low efficiency technologies in order to save investments. No substantial efforts have been made to establish an accessible funding mechanism that is supported by government or international donor establishments.

(e) *Lack of economic incentive systems*

An economic incentive system that encourages the use of highly efficient technologies in Egypt is absent. The government, for example, imposes high taxes on the import of highly efficient technologies such as integrated fluorescent light bulbs, which increases their cost and limit their use on a large scale in tourist establishments. There is also no system for commercial interest subsidy values for loans for energy improvements projects or similar economic incentives.

(f) *Debilitated institutional capabilities*

This includes the deficiency of information concerning the tourism establishment up-to-date information on energy efficiency methods and technologies and also lack of qualified human resources capable of managing and maintaining these technologies. However, a limited number of energy services companies have already started to offer these services in Egypt.

B. ENERGY MANAGEMENT IN THE TOURISM SECTOR OF LEBANON

Lebanon is known in the region as a major tourist center for its wealth of culture, heritage, scenic beauty and Mediterranean climate. Unfortunately for years, Lebanon was a victim of a terrible war, which had severely affected the infrastructure facilities and put any tourist activities on halt. This situation had reflected on data and information availability pertaining to the sector activities and performance. The sector started to revive again slowly when internal peace was attained after El Taif Declaration in 1998, and during

1993, the Ministry of tourism announced a plan for the development of the tourism sector, which included the rehabilitation of hotels, services and management training and the cleaning of beaches (32).

In 2002, a five-year project on "Lebanon-Cross Sectoral Energy Efficiency and Removal of Barriers to ESCO Operation" was launched in the Ministry of Energy and Water (MEW). The project includes conducting energy audit for twenty-two facilities from different sectors including, hotels, and restaurants. The project strategy is to address common energy- efficiency opportunities in a standardized fashion so as to achieve economies of large scale. Targeted devices include boilers, steam systems, electric motors, lighting, HVAC, power factor correction and others. Therefore, more information is expected to generate, which will allow a thorough examination of the sector, and its future sustainability.

The following sections intend to provide a brief information of Lebanon's experience on energy management particularly the restaurant sector, within the capacity of data availed to this case study.

1. Tourism in Lebanon – a brief overview

Tourism has traditionally played a key role in the Lebanese economy. The country is located at the crossroad of three continents and offers a wide diversity of archaeological and cultural tourist attractions. Furthermore, the climate permits two distinct seasons: winters in the mountains with their ski resorts, and summers on the beaches by the sea.

These unique features aside, the Lebanese government is implementing promotional campaigns and has plans to revamp its weak transport infrastructure to create a more tourist-friendly environment. With a multitude of programs underway, supported by a $30m World Bank loan, archaeological sites are scheduled to be upgraded (33).

During the past couple of years, the Lebanese Ministry of Tourism, in conjunction with the Ministry of the Environment, has been working on promoting Lebanon as an eco-tourism destination and the exchange of good practice in the area. As a result, the government is now working on introducing new legislation and a code of practice (34).

In addition, the number and quality of new hotel projects, will go a long way toward encouraging return visits, as will the increasing range of services, aimed at Arab visitors, who have always considered Lebanon a privileged destination for their holidays. They represent the main flow of tourists, both in the number of visitors and in the duration of their stay.

The number of visitors visited Lebanon rose from around 450,000 tourists in 1995 with total expenditure of around $710 million to over 630,000 tourists in 1998 with total expenditure of around $1300 million. In year 2003, the number of visitors has exceeded 1.2 million (35).

With the annual increase in visitors the hotel sector has increased due to the public and private investment in the sector. It is noticeable that the majority of the hotels are being merged and operated by international hotel chains (Le Meridien, Marriot, Intercontinental, etc.), and by operators from the region (Rotana, Jumeirah International, Metropolitan, etc.).

According to the Ministry of Tourism, the total number of hotels operating in the country in year 2000 has been 547 hotels distributed as shown in table 16.

TABLE 16. HOTELS STATISTICS IN LEBANON FOR YEAR 2000

Hotel Rating	Number	Rooms	Beds
5-star	8	2472	15981
4-star	87	8195	61200
3-star	139	7451	29569
2-star	177	6461	22919
1-star	136	2975	7682
Total	547	27554	137351

Source: Data provided by the Ministry Of Tourism, Lebanon.

Table 17 presents statistics on variation of occupancy rates (rooms and beds) throughout the year for different hotels ranking in Beirut for years 2000 and 2001.

TABLE 17. OCCUPANCY STATISTICS FOR DIFFERENT HOTEL RATINGS IN BEIRUT

Hotel Rating	Year	Average Rate (%)	Minimum-Month (%)	Maximum-Month (%)
5- star	2000	33	17.55- December	38- August
	2001	30	10- December	43- August
4A- star	2000	31.41	19.56- December	41.44- August
	2001	21.1	10.24- October	43.41- August
3A-star	2000	31.53	16.87- October	46.98- August
	2001	23.89	17.97- January	30.97-March

Source: Data provided by the Ministry of Tourism, Lebanon.

2. Energy consumption patterns in the Lebanese tourism sector

(a) *Energy Usage in Hotels*

In terms of energy resources consumed in hotels and restaurants, electricity is the highest. The electricity consumption in hotel Phoenicia Intercontinental, a five star hotel in Beirut on monthly basis is given in table 18. The data showed higher electricity consumption in the summer season affected by increased occupancy rate and the use of air conditioning systems. Detailed records of energy consumption in other hotels in Lebanon are shown in Table 19.

TABLE 18. ELECTRICITY CONSUMPTION IN HOTEL PHOENICIA INTERCONTINENTAL (FIVE STARS)

Month	MWh
January	758
February	747
March	820
April	782
May	875
June	866
July	1012
August	956
September	847
October	955
November	817
December	837

Source: Improving Energy Efficiency in the Tourism Sector: Case Study of Lebanon. Farid Chaaban, Consulting Report prepared for ESCWA, 2003.

TABLE 19: ELECTRICITY CONSUMPTION IN 4 STAR & 5 STAR HOTELS IN LEBANON (2001)

Month	Power Consumed [KWh]		Occupied Rooms	
	Gefinor Rotana (1)	Royal Garden (2)	Gefinor Rotana	Royal Garden
January	75,124	15,564	61	11
February	61,253	15,040	55	13
March	60,116	17,698	86	28
April	61,253	17,094	61	17
May	131,095	19,536	68	12
June	263,066	18,860	65	12
July	219,965	20,278	78	29
August	298,409	19,574	72	41
September	243,511	17,983	48	9
October	141,399	17,334	55	21
November	78,125	25,696	47	16
December	103,178	17,630	74	15

(1) Five stars hotel consists of 128 guest rooms, executive rooms and deluxe suites equipped to the highest international standards: www.Lebanon.com/hotels/gefinor/welcome.htm

(2) Four Stars hotel consists of 72 guest rooms and suites, is a modern building built in 1974. www.royalgarden-lb.com

Source: Improving Energy Efficiency in the Tourism Sector: Case Study of Lebanon. Farid Chaaban, Consulting Report prepared for ESCWA, 2003.

(b) *Energy Usage in Restaurants*

Restaurants constitute a major component of the tourism sector in Lebanon in general. Energy consumption in restaurants is proven to be very intensive. According to a survey carried out on 10 restaurants in Lebanon of different sizes, the amount of electricity used by the restaurants in 2002 per months and the annual electricity consumption intensity was found to be varying significantly between 48 and 455 kWh/m^2 (table 20)[35]. This variation could be attributed to the fact that reliance of these restaurants on national grid for power supply varies from one establishment to another.

Figure VI shows the average energy consumption in these restaurants on monthly basis for the year 2002. As anticipated, electricity consumption peaks during the tourism season in the hot summer days.

3. Energy conservation initiatives relevant to tourism in Lebanon [35]

(a) *The Metropolitan Palace Hotel*

The Metropolitan Palace Hotel is a five- star deluxe hotel that has been in operation since year 2001. The hotel is a member of the Al Habtour Group and is managed by the Emerati Lebanese Management S.A.L. firm. The establishment consists of a 22- floors building with 183 rooms and 42 suites. It is allocated in Sin-El Fil suburb of Beirut on a total area of 7000 m^2, and has a built- up area of 34800m^2. The total number of staff/personnel of the hotel is around 360.

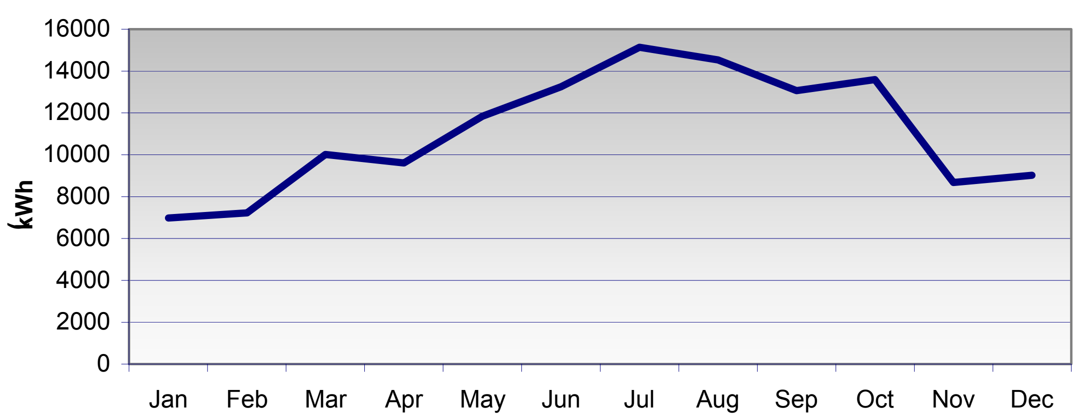
The hotel's environment policy and management code, prepared by the Chain head office, currently covers waste management, specifically separation and recycling of paper, glass, and cans. The management has also adopted a number of measures to reduce energy consumption in the hotel. Energy audit is being conducted on monthly basis as a component of the regular cost breakdown and analysis.

TABLE 20. RESULTS OF SURVEY ON ENERGY CONSUMPTION IN RESTAURANTS IN LEBANON (2002)

Restaurant No.	1	2	3	4	5	6
January	1636	376	4312	941	2905	13720
February	1704	392	4488	981	3025	14280
March	1483	225	4493	1079	2748	14463
April	1427	218	4317	1038	2642	13897
May	705	324	753	1351	2273	14337
June	735	338	10115	1407	2367	14923
July	683	550	3840	1675	2641	18171
August	657	530	3690	1610	2539	17459
September	1685	244	2979	1784	2347	18012
October	1755	255	3101	1858	2443	18748
November	1852	437	1827	1261	2298	16238
December	1928	455	1903	1314	2392	16902
Total [kWh]	16250	4344	45818	16299	30620	191150
Average [kWh]	1354	362	3818	1358	2552	15929
Area [m^2]	280	90	120	120	360	420
Seats	70	35	50	40	85	110
Personnel	26	6	8	13	22	32
KWh/m^2/year	58	48	381	135	85	455

Source: Improving Energy Efficiency in the Tourism Sector: Case Study of Lebanon. Farid Chaaban, Consulting Report Prepared for ESCWA, 2003Farid Chaaban.

Figure VI. Average electricity used by the 10 restaurants in kWh



Source: Improving Energy Efficiency in the Tourism Sector: Case Study of Lebanon. Farid Chaaban, Consulting Report prepared for ESCWA, 2003.

(i) Energy Consumption:

Electric power is provided from the national power utility, with a standby generator being used during cut- off periods, and during peak intervals for cost reduction purposes.

The total amount of power consumed in 2002 was around 10,720 MWh, and the corresponding energy intensity is around 308 kWh/m^2. Peak consumption levels are generally recorded during the summer season. In 2003, power consumption totaled around 1,154 MWh, corresponding to an intensity level of around 400kWh/m^2/year, compared to 650 MWh for the month of February, or around 225 kWh/m^2/year.

(ii) Measures Adopted for Energy Conservation

The hotel administration has adopted a series of measures aimed at reducing the energy bill. Some of these measures are:

- The whole complex is fitted with double- glazed outside windows and doors, and is operated with a building management system (BMS).
- The establishment is fitted with energy- efficient compact fluorescent lights in most of the guest rooms and other areas.
- Sub-meters are installed in different functional areas of the hotel such as the kitchen, laundry, rooms and restaurants, administrative offices, and others. Data from these meters do assist in analyzing energy cost of the hotel.
- Key cards are used in guest rooms to switch off all appliances when the room is vacant.
- Controls are fitted in guest rooms to reduce the AC output to minimum when room doors or windows are opened and when the rooms are vacant.
- The water pump is fitted with a variable speed drive that varies the water flow according to the demand, leading to substantial electricity savings.
- Communication on energy and water saving issues with guests is provided through booklets and brochures that are placed in guest rooms.
- The staff are involved, through instruction and training, in implementing energy saving policies.
- Installing solar panels is yet to be implemented due to space limitation.

(b) *Barrier removal for cross sectoral energy efficiency*

In August 2002, a five-year project on "Lebanon-Cross Sectoral Energy Efficiency and Removal of Barriers to ESCO Operation" has been launched in the Ministry of Energy and Water (MEW). The project is co- funded by the Global Environment Facility (GEF) and MEW, managed by the UNDP, and executed by MEW.

The goal of this $5.4 million project is to reduce GHG emissions in Lebanon by improving demand side energy efficiency through the creation of a multi-purpose Lebanese Center for Energy Conservation and Planning (LCECP). It will assist the Lebanese Government in strengthening its policy- making aspects and increasing public awareness pertaining to energy planning and conservation issues. The center will be structured as a financially and administratively independent entity within MEW and will receive payments for engineering services it will provide to public as well as private sector. LCECP is expected to be a soft and flexible institutional set-up, and will simultaneously undertake barrier removal activities and provide energy efficiency services to various sectors including hotels. There will also be a broad range of supporting activities including information dissemination, awareness programs, and policy analysis and program design.

Energy audit will be used as a tool to provide necessary engineering and energy marketing services pertaining to energy conservation. The strategy is to address common energy- efficiency opportunities in a standardized fashion so as to achieve economies of large scale and high levels of participation. Energy audits for 22 facilities from different sectors including commercial buildings, hospitals, hotels, and restaurants have been conducted. Targeted devices include boilers, steam systems, electric motors, lighting, HVAC, power factor correction and others.

Other activities will include feasibility studies, technical advise, financing themes, marketing and promotion, and demand assessment.

(c) *Enhancement of the permanent environmental awareness unit*

The European Commission LIFE program (EC-LIFE), managed by UNDP and executed by the Ministry of Environment (MOE) funds a project entitled “Enhancement of the Permanent Environmental Awareness Unit at the Ministry of Environment”. The main objectives of this project include coordinating with the media to ensure full and accurate coverage of environmental issues, building the individual and networking capacity of the local promoters of environmental awareness, such as NGOs, private sector, public institutions, schools and universities, through the provision of technical assistance and conduction of common campaigns and developing a centralized system for the dissemination of environmental awareness material within the unit making use of MOE library and website.

The project is conducting a series of workshops aimed at “Greening Supermarkets, Banks and Restaurants in Lebanon”. The objective of these workshops is to provide theoretical and practical knowledge on the environmental impairment from the daily work in banks, supermarkets and restaurants. Practical possibilities for improvement and the change towards a more sustainable and environmental-friendly attitude and operation will be assisted.

V. THE CONCLUSIONS: GUIDELINES FOR EFFICIENT ENERGY MANAGEMENT IN THE TOURISM SECTOR

The tourism sector is rapidly developing, to become a prominent economic sector worldwide, as well as in the ESCWA region. However the economic health of tourist facilities, particularly in coastal area, depends largely of maintaining the quality of its primary resource: the environment, and reducing the operating expenditures through adopting appropriate production and consumption patterns for services such as energy and water supplies. Meanwhile, the JPOI adopted by WSSD, has called for adopting measures for promoting “Sustainable Tourism Development” (STD) with emphasis on the need for developing and implementing programmes on capacity building and awareness in the relevant areas to STD. Given the above, and that energy systems are an integral element of the design, construction and operation of all kinds of tourist facilities, the appropriate planning, design and management of energy systems, particularly for efficient energy use are of prime importance.

It was due to the above that ESCWA has included in its (2002-2003) work programme on Energy an activity on “A Guide to Efficient Energy Management in the Tourism Sector”, with the primary objectives to help public and private sector planners and developers, as well as the management and operating staff, in the tourism sector to: (1) understand the interrelationships among the major systems required for a successful sustainable development of tourist facilities with focus on the required energy systems, and (2) to conceptualize and recommend options for energy systems, design and management, that minimizes the consumption of scarce energy resources and reduce the energy systems environmental impacts.

This document, “the guide”, has presented in the first four chapters an organized discussion and analysis on the different issues relevant to energy management in the tourism sector, with emphasis on the hospitality sub-sector including hotels, tourist villages and restaurants. The discussion is covering:

- Sustainable Tourism Development “STD” concepts, goals, priorities and measures that have been adopted by global conferences and concerned international organizations, the energy relevance to STD and some of the initiatives developed worldwide to upgrade energy efficiency in tourism.
- An assessment of the different energy supply options for tourist facilities indicating their suitability for different energy applications in the sector, as well as the typical energy loads and consumption profiles for different applications and the impacts of the operating conditions on such patterns.
- Recommended design strategy and “systems” approach for energy systems, within the overall planning and design phase of the tourist facility was recommended, as well as a set of design options and guidelines that can improve energy management and upgrade the energy production and use efficiencies in the tourist facilities, and
- A brief description on the Egyptian and Lebanese experiences in the field reflecting the nature of the tourism development in the region and the efforts directing towards improving energy management in it.

The content of the above-described part of “the guide” constitutes a brief consolidated background information on the different relevant issues of efficient energy management in the tourist facilities. It provides directly relevant information and approaches, that a planner, developer, designer and managers would need to know in support of the design decisions to be made during the development phase of the tourist facility or in support of setting management strategies and programmes for energy services in case of operating facilities.

Furthermore, this chapter of the guide (Chapter V) includes the above short summary on the objective and content of the guide, as well as presenting the findings and recommendations identified through this guide in five consequent sections, each devoted to a specific issue of efficient energy management in the tourism sector. The five sections are designed in a way to present short action oriented information, easy to read and follow, on relevant issues, and the topics of these sections were selected to cover the concerns of the developers, designer, managers and operation staff of tourist facilities, as well as to address the highest energy consuming application in tourist facilities.

Therefore, the following five sections cover guidelines for: (1) the energy systems design strategy and systems approach, (2) energy efficiency in heating, ventilation and air conditioning, (3) energy efficiency in lighting (4) energy efficiency in water heating and finally, (5) energy efficiency in the kitchen and laundry services.

GUIDELINES FOR ENERGY SYSTEMS: DESIGN STRATEGY AND SYSTEMS APPROACH

FOR DEVELOPERS & DESIGN TEAM

At the very outset of a tourist facility project, development, the developers and the design team should set a design strategy and decide on a "systems approach" in making design decisions.

The design strategy should target to design a facility that is integrated within itself and its environment, while satisfying guest comfort, access to energy and water services as well as reduced operating costs.

Since energy systems are an integral element of the design, construction and operation of tourist facilities, and have a pivotal role in its success and failure. They should be carefully considered in developing the facility design strategy and systems approach.

THE DESIGN STRATEGY

The strategy should include the following regarding the energy systems design.

FOR OVERALL FACILITY

- Consider a "whole building approach", where the architectural design is integrated with the building's energy systems design.
- Consider carefully the physical layout of the facility and clustering of service areas to minimize electrical distribution systems, centralize plumbing and water supply and minimize transportation requirements.
- Ensure guest satisfaction through using reliable and efficient power & water supplies.
- Enhance staff information on the need to upgrade energy efficiency and promote their participation in the development process of the facility.

FOR ENERGY SYSTEMS

- Goals for energy performance and consumption patters have to be set early in the planning stage.
- As appropriate. The energy supply system should minimize the use of fossil-fueled technologies and maximize the use of cost effective renewable energy technologies.
- Encourage the use of centralized electrical supply systems, as possible to level the load demand over time and upgrade system efficiency.

THE DESIGN APPROACH

The design approach for energy systems in a tourism facility should target:

- Reducing of both electrical and thermal peak loads to reduce system size and upgrade energy efficiency.
- The electrical supply system should be designed to be reliable, efficient, commercially available, and can be easily maintained.
- Integrating renewable energy as appropriate, particularly for solar water heating and photovoltaic / battery pole lights for small lighting loads.
- Upgrading energy use efficiency, through passive building designs, smaller modular power units and energy efficient fittings.
- Evaluating competing options, to select the least-cost, efficient and sustainable options.
- Iterating the design process, to optimize the system selection.

GUIDELINES FOR ENERGY EFFICIENCY IN HEATING, VENTILATION & AIR CONDITIONING

FOR INVESTORS

Encourage designers to:

- Follow the whole building approach, where building and energy designs are integrated.
- Incorporate passive features as appropriate in the building design.

FOR DESIGNERS

Consider all available building design options including passive and active solar designs, using most efficient and most reliable conventional systems. Meanwhile evaluate and consider the following:

- Upgrade windows and doors: double- or triple- glazed low emissive insulating windows, reflective coating or windows, and insulated doors.
- Consider using high-pressure water atomization instead of compressed air humidification for substantial energy savings.
- Install self-regulating controls for ventilation systems.
- Interconnect the controls for spaces with separate heating and cooling systems to prevent simultaneous heating and cooling.
- Install load analyzers in the controls of multi-zone and dual duct systems to optimize hot and cold temperatures.
- Install load analyzers in the controls of terminal reheat systems to optimize the supply air temperature and minimize the reheat control.
- Install time clocks to shut down the air system or switch to 100% recirculation in unoccupied spaces.
- Install control interlocks to shut down heating or cooling system pumps when output is not required.
- Install economizer controls on central air systems to use outdoor air as a replacement to refrigerated cooling when appropriate.
- Install automatic control valves at unit heaters and fan-coil heaters to shut off water or steam flow when fans are not running.
- Consider installing variable speed drives to centrifugal chillers (if used), which save up to 40% compared to a conventional chiller.
- Consider istalling energy management and control systems for controlloing temperature, humidity and time of day for meeting rooms, guest rooms and other public areas.
- Install high efficiency HVAC systems, select high efficiency ratings at least 10 EER / SEER, and humidity capacity at least 30%.

FOR STAFF & MANAGEMENT

Manage HVAC loads and operate the system for reducing loads and upgrading efficiency through:

- Check and maintain readings of control components such as room thermostats and air temperature controllers and verify setting of time clocks.
- Establish minimum and maximum temperatures for heating and cooling during occupied and unoccupied periods and re-adjust controls accordingly.
- Adjust airflow rates to suit changing occupancy conditions and use of building space and prevent restrictions of airflows by checking or replacing air system filters.
- Ensure that vents are closed in winter and kept open in summer.
- Shut off exhaust and make-up air systems to areas when not in use such as kitchens and laundry.

- 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%.

GUIDELINES FOR ENERGY EFFICIENCY IN LIGHTING

FOR INVESTORS & DESIGNERS

During design and construction phase, consider:

- To invest in occupation cards to disconnect air conditioning systems and lighting when guests leave the room.
- To invest in efficient lighting, in all areas as appropriate.
- To take full advantage of daylight (especially in loddy areas) when designing windows and skylights.
- To install photocells that turn on and off in response to natural daylight.
- To install sheer curtains in guest room that filter sunlight but give privace to reduce need for electricity lighting.
- To install occupancy sensors (motion sdetectors) which can switch on lights when movement is detected and switched off 15 seconds after no motion.

- To choose wall colors that reflect daylight as much as possible. White and cream colors reflect sunlight by 60 – 90%.
- To Consider photovoltaic poles for isolated lighting.

FOR STAFF & MANAGEMENT

- Frequently assess the type and use of lamps to ensure maximum efficiency.
- When replacing all old lamps in an institution /area, consider:
  - Group relamping with new efficient models at one time.
  - Changing tungsten lamps by compact fluorescent lamps (without changing fittings).
  - Fitting reflectors to fluorescent tubes, this can reduce the number of tubes needed by half.
  - Clean fxtures, lamps and lenses every 6 months by wiping off dust and grease deposists.
  - Replace incandescent lamps in exit signs with compact fluorescent lamps. It reduces energy consumption by 50 – 75%. Also, fluorescent lamps last 10 – 20 times longer.

- Turn off lights when:
  - Incandescent lights are not needed.
  - Fluorescent lights will remain off for at least 15 minutes.
  - HID incandescent lights will remain off for at least one hour.
- Turn off lights in:
  - Restaurants between serving meals.
  - Services areas (laundry, stores, kitchens) between working hours.
- Use efficient lamps in areas where lights would be on for long hours.

- Install dimmer switches that can reduce light intensity to 10 -20 % during the day. They can be used in hallways and lobbies where lights should be on 24 hrs.

- Use High –Intesity Discharge (HID) lamps for outdoor lighting.

- Replace lenses if they turn yellow.
- Clean fixtures more often when they are a part of HVAC systems.
- Establish a regular cleaning program for windows and skylights to help keep light reflection to a constant dependable level.

FOR GUESTS

- Turn off lights, TV and other electronics when leaving the room.
- Make use of natural light as much as possible.

GUIDELINES FOR ENERGY EFFICIENCY IN WATER HEATING

FOR INVESTORS

- Insulate hot water storage tanks and piping to reduce heat loss.
- Evaluate 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.
- Evaluate and install as appropriate waste heat recovery systems on large generating units, laundry, etc.
- As appropriate, install solar water heating systems for guest rooms, swimming pools, and other services equipment.

FOR STAFF & MANAGEMENT

- Set water heaters thermostats at not more than 50 -55 ºC, for guest room water.
- Use a booster heater for higher water temperatures for dishwaters and laundry equipment use.
- Minimize temperature of water used for cleaning utensils (do not reduce the temperature below the permissible level).
- Adopt regular boiler tuning programme (adjust fuel / air ratio) to maintain higher efficiencies.
- Check toilets, faucets and showerheads for water leaks and repair immediately.
- Use low-flow shower-heads (2 ½ to 3 gallons per minute are recommended)
- Check and maintain gas boilers and water heaters twice a year to reduce scales and increase efficiency.
- Replace inefficient water heating systems.
- Consider water treatment to prevent scaling.
- Train and educate staff to follow correct procedures for achieving efficient energy use.

FOR GUESTS

- Optimize your hot water consumption as possible; you may reduce the length of shower (shower load is typically the single largest hot water load in a hotel).

GUIDELINES FOR ENERGY EFFICIENCY IN KITCHEN AND LAUNDRY SERVICES

KITCHEN SERVICES

COOKING EQUIPMENT

- Shut cooking equipment off when not in use. Pre-heating should not require more then 10-minutes for large ovens and 5 minutes for fryers.
- Use pots and pans of appropriate size for the heating element to prevent under-use or over heating and place pots near each other to reduce heat loss.
- Clean grills and grease filters daily for greater heat transfer.
- Do not heat up several heating elements if you need only one.
- Keep bottom of pots and pans free from deposits to get good heat transfer and ensure good contact (flat bottom) and maximum exposure to heat.
- Cover pots and pans with lids while cooking.
- Use pressure cookers to reduce cooking time.
- Install timers for cooking operation to shut off equipment automatically at predetermined times.
- Replace inefficient cooking equipment
- Service all gas cooking equipment at least twice a year for greatest efficiency.

OVENS

- Use only the size of oven that is needed for the job.
- Load and unload ovens quickly to avoid heat loss.
- Keep fan blades on convection ovens clean.
- Use in-the-meat thermometer with gauge outside the oven.

DISHWASHING

- Shut off booster of dishwasher and glass washers with solenoid valve when equipment is off.
- Install heat recover unit on dishwasher to recover energy from final rinse cycle.
- Operate dishwasher and glass washer only when full.
- Maintain hot tap water at 50ºC.

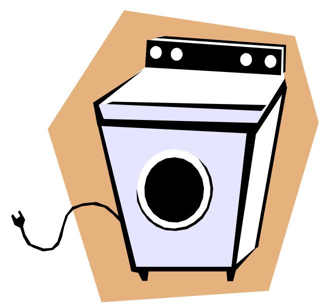
REFRIGERATORS

- Do not place hot food straight into refrigerated spaces.
- Consolidate food storage in refrigerators and walk-ins. If you can empty a unit, turn it off.
- Arrange heating equipment together away from refrigerator and freezer.
- Turn off lights in cold storage rooms. Make sure doors close properly and gaskets are tight.
- Place frozen and pre-cooled goods immediately into storage to avoid warm up and waste of energy for re-cooling.
- Keep freezer coils from ice build-up.
- Perform regular maintenance on refrigeration equipment.

LAUNDRY

- Match laundry operating hours to actual needs of operation and actual load. Avoid extended operation.
- Operate all equipment fully loaded at rated capacity.
- Arrange schedule of housekeeping to ensure timely flow of used linen being returned in the morning hours to avoid starting and stopping equipment.
- Close steam trap to laundry at times when equipment is not in use.
- Repair all leaks: water, steam, and compressed air.
- Operate supply and exhaust fans in accordance with actual operating time.
- Stop compressor for laundry when not required.
- Maintain hot water at 60ºC. Consider low temperature wash formulas. Temperature could be reduced from 85ºC to 60ºC by using special detergents.
- Check steam traps for proper functioning. Do not allow flash steam or live steam from leaking trap.
- Check condensate losses and repair immediately. All condensate must be returned to the condensate tank.
- Check temperature controls and thermostat for proper functioning.

- Prolong spinning cycle to achieve final water retention of <55%. Dryers and flatwork ironer will require less energy.
- Review tumbler operation time to prevent over drying.
- Run fewer tumblers constantly instead of intermittent operation.
- If separate hot water tanks for the laundry exist, install a timer to shut off primary energy supply to heat exchanger during off-duty hours.
- Disconnect hot water circulating pump if laundry is located near heat exchanger.
- Consider installation of heat recover system.
- Consider higher efficiency equipment when replacing existing units.
- Insulate ironer chest and piping underneath ironer.
- Install a canopy (hood) above the rolls, to retain the heat and properly vent to atmosphere.



Annex I

A BRIEF ON THE CURRENT POLICIES AND INITIATIVES FOR TOURISM DEVELOPMENT IN ESCWA MEMBER COUNTRIES

ECSWA member states are placing more emphasis on promoting tourism and realizing its importance for national economies. Activities surrounding tourism in the region fall into four main categories: religious (mainly pilgrimage), cultural and natural, and business. A breakdown of tourism data according to these categories is beyond the scope of this report. The number of hotels has been consistently increasing due to the public and private investment in the sector. In what follows is a briefing of some of the activities and projects carried out in some member countries to promote tourism in general, and ecotourism in particular.

Bahrain is currently witnessing a very rapid growth rate due to the governmental expenditure aimed, amongst other objectives, to diversify the economy. A $1 billion project to develop Bahrain Financial Harbour in Manama is currently under construction, in addition to other projects of the same scale in many areas of the country. In 2002, the tourism sector had recorded a moderate mainly due to increased number of visitors from the region. Developing a racetrack for Formula 1 with all the lodging facilities is expected to further solidify tourism in the country.

Egypt ranks first amongst all regional countries in attracting foreign visitors due to its unique cultural resorts, location, and natural heritage. In 2002, the country has received over 5.2 million visitors, an increase of around 12% compared to 2001 figure. An estimated 25% of the total visitors to the region had destination in Egypt and contributed to over 43% of export services [(15)]. Also, around 70% of the tourists to Egypt are from European countries [(4)]. Between 1996 and 2001 the hotel sector has witnessed an annual growth rate of 15%, focused mainly in the Red sea and south Sinai regions, in addition to Greater Cairo Area.

In Jordan, tourism is one of the largest foreign- exchange sources and the sector receipts account for 9% to 12% of GNP [(16)], the Government has borrowed around $40 million from the World Bank for its Second Tourism Development Project. This Project is to create conditions for an increase in sustainable and environmentally sound tourism in regions like Petra and Wadi Rum. Moreover, the tourism industry in Jordan has been heavily investing in hotels and other visitor activities, transport, and promotion efforts.

Kuwait historically has a limited tourism sector, but commercial plans and hotel projects have been developed in order to expand the tourism sector. In 2002, visitors to the country increased by around 9% compared to 2001 figure, most of these being business travellers.

Lebanon, with its diverse cultural and natural heritage, is a tourist resort for regional as well as international visitors. In 1995 around 450,000 tourists visited the country and spent around $710 million. In 1998, the figures rose to over 630,000 tourists with total expenditure of around $1300 million. In year 2003, the number of visitors has exceeded 1.2 million. The newly reconstructed Beirut city centre has been added to the long list of tourism attraction in the country. Lebanon has established a committee comprising different stakeholders to promote the concept of ecotourism and to ensure a sustainable tourism sector. An "Environmental Audit Manual for Hotels" has been published in collaboration with several international organizations.

In Oman tourism has been predominantly of business nature. Currently the government is focusing on developing the tourism sector, and for this purpose, several projects are underway to build new hotel and tourist resorts in regions like Al-Sawadi and Ras Al-Hadd.

In Qatar, the government has prepared a number of projects to develop the tourism sector in order to diversify the economy that relies mainly on exporting natural gas. The Qatar General Tourism Authority has been established for this purpose, and other projects are underway to build the relevant infrastructure such as a new airport and a number of hotels and tourist resorts.

In Saudi Arabia, tourism falls mainly under the religious category (pilgrimage). The Government has provided incentives for project worth around $2.67 billion (SR10 billion) aimed at promoting tourism [17]. Resorts, hotels, and furnished villas have been developed by the private sector, bringing the total outlay in the sector to over $8 billion (SR30 billion). Also the Government is focusing on increasing internal tourism by encouraging the citizens to spend their holidays visiting different regions of the country.

Tourism in Syria is of great potential due to the diverse cultural heritage of the country. The government is providing various incentives to expand the tourism sector through a number of projects. In 2002, the country has witnessed a significant increase in visitors from the region.

The United Arab Emirates has been exerting a great deal of effort to attract tourists especially those visiting the country while attending conferences and exhibitions and for shopping. The number of tourists to UAE has increased from 1.67 million in 1993 to 3.9 million in 2000 [14,18]. Projects are being constructed in Dubai and there are significant investments in the tourism sector in other regions as well.

In Yemen, the tourism sector offers around 6% of the total employment in the country. Since the early 90's, there exists a close cooperation between the government and several international bodies on projects aimed at developing human resources in the hotel and tourism sector.

Annex II

A BRIEF ON THE CHARACTERISTICS OF THE RECOMMENDED ENERGY TECHNOLOGIES FOR TOURIST FACILITIES

Technology advances and engineering practices during the previous years have made energy producing and consuming technologies commercially available with higher efficiency and reliability. These technologies can be used to supply energy services to the tourism sector. As well, some retrofit energy equipment and control fittings can help upgrading the efficiency of existing equipment (i.e. cogeneration, power cut-off cards, etc.).

The following is a brief description of two sets of technologies that are recommended for use to upgrade energy efficiency in tourist facilities. The first set includes more efficient electric and thermal energy producing technologies and the second are more efficient energy end-use technologies.

A. ENERGY PRODUCTION SYSTEMS

1. Steam production systems

Steam production and distribution systems are one of the main energy consuming systems within tourist facilities. The produced steam is used for space heating, hot water for guest rooms, swimming pools, laundry and kitchens. Boilers are used to produce steam at 50-100 lb/in pressures, with an efficiency range between 76-85%. Heat loss in boilers takes place via the chimney with hot exhaust gases through the outer surface of the boiler and when the boiler is not well insulated.

Therefore improving steam production efficiency can be achieved through; adjustment of fuel/air ratio to decrease extra air, continuous maintenance of inner surfaces cleanliness, and installing exhaust heat recovery devices whenever possible technically and financially. It is preferable to include exhaust heat recovery devices in the first stages of design or to replace the old boilers during the process of renovation and replacement, this will upgrade boiler efficiency by 2 - 5 percent and allow for saving the much needed investments being wasted using less efficient boilers.

In addition, 10 - 15 percent efficiency improvement can be also achieved by appropriate operation and maintenance programme including; water treatment, vapour retrieving and loads control. Other alternatives are linked with steam distribution system including; condensate return systems, vapour leak prevention, vapour trap repair and heat insulation, which result in 13 – 16 percent efficiency improvement. Therefore the application of all above-described repairs and measures can improve the steam production and distribution system efficiency by 25-35 percent.

2. Hot water production systems

Hot water is mostly in guest rooms, swimming pools, and for cooking and laundry. A number of different types of boilers have now been introduced which offer energy savings. These include:

(a) Condensing boilers

These boilers extract heat from flue gases to increase their operating efficiency. Because these boilers need to operate at a lower temperature than conventional boilers, they are well suited to providing–under floor heating, fan convectors, or swimming pools.

(b) Direct gas-fired water heaters

These water heaters allow efficient generation of hot water during off-peak summer times and, thus allow the main boilers to be switched off. When linked to combined heat and power units, these boilers can deliver considerable efficiency by making maximum use from the heat from this equipment.

(c) Small scale heat on demand water heaters

These water heaters to service basins and showers can allow some boiler capacity to be closed down during the summer months and, thus, deliver significant savings. They are of particular value in the kitchen area where hot water demand is periodic, where there are opportunities for demand management (by, for example, ensuring that staff use bowls of water for cleaning vegetables rather than leaving taps running) and where water is used for specific purposes. These units can be managed to deliver water at the appropriate temperature for the task, for example hand washing, thus reducing the need for the addition of cold water.

(d) Solar pre-heating for hot water

Even in the UK, solar energy can provide a cost effective way to pre-heat hot water (as long as appropriate mechanical back up controls are also provided to retain the water temperature on dull days). Once the initial equipment to capture the heat of the sun’s energy has been installed, the energy source is essentially free.

3. Cogeneration

Cogeneration, also known as Combined Heat and Power (CHP) is the production of electricity and heat in one single process for dual output streams. Conventional power stations operate at only about 35 to 55 percent efficiency and so is a relatively inefficient way of producing energy. Most of the energy that power stations consume is wasted as heat. CHP effectively achieve up to 90 percent efficiency giving energy savings between 15-40 percent can be compared to the conventional generating units.

CHP units can be installed into medium to large hotels where they consume natural gas or occasionally oil, which they convert into electricity for the hotels operation. The unit is equipped with a heat recovery unit, which captures and makes use of the waste heat produced during this process, thus making these units extremely efficient. The value of the heat and electricity generated in such units is higher than the cost of the fuel and, hence, these units can be profitable as long as the difference between purchasing the CHP plant and purchasing fuel from the power station off-set themselves.

To be efficient, CHP plant should be sized correctly to maximize the number of hours for which it operates (this means matching the plant to the base load energy demands in the hotel). Usually CHP is cost effective in hotels if it operates for more than 4,500 hours a year.

The advantages of CHP systems relate to its cost saving benefits and to the ability to utilize waste heat from the process for secondary purposes, preferably in facilities were electric to hot water demand ratio is consistent with CHP technology requirements. In addition, cogeneration systems can be configured to power desalination systems in remote tourist areas.

B. ENERGY END-USE SYSTEMS

1. Lighting systems

There are various lightening systems available, each with varying degrees of efficiency and cost. Light bulb manufacturers have been working for decades to improve bulb efficiency. Fluorescent lighting is the most commonly used lamp type within the commercial sector, and they produce a flat white light, requiring a special lighting ballast to regulate the current they receive. Engineers have designed fluorescent bulbs that plug into an ordinary socket and produce a more pleasing light. Fluorescent bulbs are now available in many shapes and wattage. The most commonly used lamp sizes are the 4 and 8 foot straight tubes, followed by 3 and 2 foot U-tubes and circular tubes. These types of fluorescent lamps are about four to five times more efficient than incandescent and last for about 10 years, 20 times longer. The compact fluorescent table lamps (7 to 22 watt) payback in 12-18 months, while the compact fluorescent flood or halogen lamps payback in 4-8 months only.

2. Heating, ventilation and air conditioning systems

Heating, ventilation and air conditioning systems (HVAC) are major energy consuming operation in a hotel, which rated by their capacity accounts for 50-60 percent of energy consumed in tourist facilities.

Capacity is measured in BTUs/hour of cooling capacity. Room air conditioning systems are typically between 5,000 and 20,000 BTUs/hr. Central air conditioners have much large capacity and are frequently referred to in terms of tons of cooling capacity. One ton is equivalent to 12,000 BTUs/hr.

Air conditioners are also rated in terms of their Energy Efficiency Rate (EER) which is the ratio of cooling output divided by the power consumption, the higher the EER, the more efficient the system. An average new room air conditioning system has an EER of 8. An old, poorly maintained, central system can have an EER of less than 5, while the most efficient central systems on the market have an EER of 15.

Seal cracks around windows, door and through-the wall or window type HVAC units with caulk to prevent heat losses and improve HVAC efficiency. Meanwhile, one of the most advanced energy management technology widely used in centrally air-conditioned or heated buildings is the Energy Management and Control System (EMCS). It is a programmable control system used for scheduling and controlling energy-consuming equipment in order to reduce power peaks and the amount of energy consumed. In short, an EMCS is the overriding system that determines how and when all energy components work most efficiently.

3. Kitchen and laundry equipments

The most energy consuming kitchen equipment includes ovens, cookers, freezers, dishwaters, water heaters, etc. Cost-effective kitchen energy conservation opportunities can be applied to such equipment. For example, toaster ovens and fryers can incorporate an energy mode for low demand periods, saving up to 75 percent in energy costs. Also redesigned fryers now use better surface area heating so that lower temperatures can be used without sacrificing food quality. *(reference energy management book).*

High-pressure steamers can be used in place of boiling pans. The cooking process is much quicker than the conventional methods and the amount of energy consumed is thus reduced. The Operation of Microwave oven on the other hand requires a low degree of energy demand compared with traditional cooking method and represents a good energy saving option.

Low temperature dishwashers can be fed from normal hot water supplies (60ºC) and use a very low volume of fresh water for each cycle. These machines rinse at 60ºC instead of the usual 80ºC and are sanitized by chemicals instead of by hot water. There is therefore no need for energy intensive water tank sustainer heaters or booster heaters to operate. Other dishwashers are designed to recycle the rinse water as the pre-rinse for the next wash (thus retaining the heat). Tests have shown that the resulting savings in water and heating amount to energy saving of up to 80%.

For laundry equipments, energy use efficiency can be achieved through efficient operation of hot water heaters, repair leaks, insulation of storage tanks and distribution piping are measures to reduce electricity consumption in the hotel laundry. Horizontal-axis (H-axis) washing machines, also called front loaders, are far more energy-and water- efficient than conventional top-loading, vertical-axis machines. Clothes dryer efficiency is measured by the weight of clothing dried per kWh of electricity. The minimum rating for a standard capacity electric dryer is around 1.5 kg/kWh.

4. Electric loads management

Electric load management within tourist facilities refers to the control of electric energy use, with the objective of reducing the level of peak loads and smoothing the day and seasonable load profiles, without decreasing total energy consumption.

In hotels, where electric energy consumption is mainly brought from integrated electricity network, decreasing the maximum load of the hotel enhances the economics of the integrated network, and may decrease the power penalty, fees paid by the electricity authority.

In establishments that generate their own electric energy using diesel engines, initiating load management can reduce the requirements of generated loads and therefore reduce needed investments and also maintenance and operation costs.

Load administration can be activated within hotels, by postponing the operation of laundry, water desalination units, and watering plants surrounding the hotel till after peak time. Daily load measurement in summer and winter can determine the electric load pattern and the hotel's peak time.

5. Occupancy sensors and key card systems

Occupancy sensors are used to control the operation of the electric services in guest rooms, they determine whether the room in question is occupied at the time or not. There are several different type of sensors, some operated by detecting the heat emitted by person's body, and some by sensing movement using ultrasonic Doppler technology.

Other type of sensors is a card reader control system which contains an electric relay switch that controls the lighting and air conditioning services when the guest enter his room and inserted the card in the designated place. For such a system to be effective, the control card should be the same as the one for the gust room door so the guest taken the card with him when he leaves permitting the system to work as planned. It is estimated that the use of card reader-type occupancy sensors could probably reduce average peak power levels by 5%- 10% and energy consumption by 15% to 20%. *(Reference: energy management book).*

Annex III

ENERGY AUDIT STAGES IN TOURIST FACILITIES

The energy audit is an essential step towards the establishment of a professional energy-management program within the tourist facilities. The auditing process is usually carried out by or under the supervision of an experienced consultant. The energy audit in an existing facility is usually performed through a series of consequent stages:

A. Data collection and analysis

At this stage, the pattern of energy consumption in the tourist facility is recorded, using a complete operation cycle, either (one day) or a season (summer / winter for example). It is also necessary to note the operational energy load profiles within the hotel, with regards to its operating hours daily and annually.

On site field measurements are sometimes taken by using portable measuring equipment. This stage will be considered completed when a good level data is collected; therefore giving a full picture of energy consumption within the facility, including the levels of energy per activity. By doing this the highest energy consuming activities can be identified and findings can be compared with reference data.

B. Field Surveys

To assess how effectively energy has been managed, and to evaluate the levels of improvement and change that has occurred, field surveys are carried out. Here, an experienced energy management professional has to look at how effective is the energy management system in the facility and identify options for improvement, according to the priority criteria identified by senior management.

It is important to mention that an economic assessment is done for every option of the energy conservation options. This process starts from a calculation of the simple pay-back period to a calculation of the present net value for the monetary inputs of each option or any other economic evaluation method for projects in general.

C. Implementation

At this stage, technically and economically viable energy recommendations are looked at by senior management teams, who will then decide whether or not they would implement the suggested changes.

Most of the times low cost, less sophisticated changes are made first before implementing any high cost options which are more technically sophisticated.

D. Monitoring and follow-up

At this stage, impacts and effectiveness of implementing the recommended energy regulations, options are measured and evaluated in terms of efficiency improvement, consumption levels, and decreasing energy costs. It is important to mention that the energy management system is a continuous process that is implemented and followed in a constant way, which guarantees the constant and continuous improvement for energy efficiency inside the facility, and thus, the contribution in stopping the environmental impacts of the activities of this facility.

Annex IV

ENERGY AUDIT CHECKLISTS FOR HOTELS *

A. ENERGY CONSUMPTION

GENERAL INFORMATION

Audit Site	
Audit Date	
Auditor(s)	
Site Personnel Responsible	

Notes:____

____

____

1. If applicable, write down the name of the person responsible for energy management

Name/ Title ....
E-mail ....
Telephone ....

2. List the different types of energies used in the hotel

Electricity ☐ Steam ☐
Heat ☐ Other, please specify ________________________

3. List the different energy sources used in the hotel

Heavy fuel ☐ Light fuel ☐
Diesel ☐ Renewable energies ☐
Natural Gas ☐ LPG gas (kitchen gas) ☐
Oil (lubricating) ☐ Other, please specify ________________________

4. Has an audit been undertaken to identify energy consumption and minimization? ____________________

If yes, write down the name of the agency that conducted the audit ____________________________

What was the outcome of such an audit? Were any corrective measures undertaken accordingly?

____

____

____

* *Source:* Environmental Auditing Manual for Hotels, 1st Edition, prepared by SPASI (Strengthening the Permitting & Auditing System for Industries), in collaboration with UNDP, EU, and Lebanese Ministry of Environment., slightly modified by ESCWA

5. List by order of importance the main energy consuming divisions in the hotel (guest rooms, administrative departments, kitchen, cool storage room pool, car parks, etc.)

Energy Consumption Level (Categories)	**Division's Name**	**% Consumption**
Highest Energy Consuming Division (s)		
Average Energy Consuming Division (s)		
Lowest Energy Consuming Division (s)		
Other.		

6. List by order of importance the main energy consuming applications.

Energy consumption per application

Name of Equipment, etc (i.e. Air Conditioning, Heating Unit, etc).	Age of Equipment.	Name of division where Equipment is located (i.e. laundry Room, etc).

7. Are there defined maintenance programmes to ensure that all machinery and auxiliary equipment operate at optimal efficiency? ☐ Yes ☐ No

If yes, describe the regular maintenance programme below, (where and when they are Applied)

____

____

8. Is energy efficiency taken into consideration when purchasing new equipment? ☐ Yes ☐ No

9. Is there a desire to replace any high energy consuming equipment? ☐ Yes ☐ No

If yes, specify which equipment, when and how, and the advantages/disadvantages of such replacement.

____

____

ELECTRICITY

10. Describe the governmental tariff scheme applied to the hotel (i.e. fixed rates, other)

____

____

11. What is the average monthly electricity consumption (i.e. total kWh/month)? ______________________

12. Specify in percentage the total amount of electricity used from national local guides and the percentage covered by on site generator usage or renewable energy sources.

Electricity Consumption

Source	**Percentage**
Electricity Grid.	
On site Generator	
Other (Renewable Energies, etc).	
Total	100%

13. What is the level of peak loads and the peak hours? ____

14. Describe the strategy applied to reduce electricity consumption during peak hours.

____

____

15. Are there penalties being paid for the power factor? ☐ Yes ☐ No

If yes, what types of measures are applied to increase the power factors?

____

____

16. Are there any monitoring programmes for electricity consumption? [1] ☐ Yes ☐ No

If yes what are they?____

Main Electricity Consuming Applications

Type of Application	Location	% Electricity Used of Total Electricity Consumption.

17. In the table below, provide a breakdown of the main fuels consumed by applications (i.e. production process, heating systems, lighting systems, etc). By order of performance.

Fossil Fuel Consumption by application

Fuel Type	Application	% Consumption	Observations.

18. Are there any monitoring programmes for fuel consumption? ☐ Yes ☐ No

If yes, describe the aim and purpose of these programmes.

____

____

____

RENEWABLE ENERGY

19. Are renewable energies used? ☐ Yes ☐ No

If yes, describe the type of renewable resource and application used.

____

____

[1] The data provided in the table will be more relevant, if a regular monitoring programme is in force.

When and where in the hotel is renewable energy used, and where are the total energy savings achieved?

____

____

____

20. Actual Practices to reduce energy consumption.

✓ Tick if stated measure is practiced in the audited hotel and **X** if it is not.

☐ All refrigerators, cold rooms, and freezer doors seals' are working properly.

☐ A walk-in cooling room for storage of goods and small refrigerator for everyday use exist.

☐ Stickers exist, requesting the guests to switch off appliances and lighting when not in use.

☐ Lighting levels are adjusted to ensure comfort levels and minimum energy use given.

☐ Efficient low energy lights (fluorescent lights) are installed.

☐ Passive building designs were considered.

☐ Walls are painted with light colors.

☐ Double –glazing on windows is installed.

☐ Sensors in parking lot lights are installed (which automatically switch-off if no movement is detected).

☐ Photovoltaic solar powered lights are in used in the garden, and walk ways.

☐ Solar energy for water heating is in use.

☐ Systems that control the temperature in the halls are limited to be used by hotel staff only.

☐ Equipments that monitors the amount of fuel, steam and hot water consumption are Installed.

☐ Automatic shut-off systems for air conditioning & heating are installed (turn off when windows are open and or when a guest leaves the room).

☐ Heat is recovered from swimming pools and the laundry rooms.

☐ A maximum value for hot water (ex: 50 C) is set.

☐ Taps are controlled by sensors when applicable.

21. Describe any other practiced measure, if in use

____

____

____

PLANNED STRATEGIES TO REDUCE AND MONITOR ENERGY CONSUMPTION

22. Are energy saving programmes planned for the future? ☐ Yes ☐ No

23. Are there any programmes planned for the future? ☐ Yes ☐ No

B. AIR EMISSIONS

1. Does the hotel operate a boiler?[1] ☐ Yes ☐ No

If yes, please state: Date of installation. ____________

Heat input Joule/hr ____________ Type of fuel burned ____________

Sulphur content of fuel ____________ Yearly fuel consumption ____________

Average daily/yearly operational time ____________

What is the destination of steam/hot water generated from the boiler? ____________

Quality of steam generated from the boiler ____________

Source and quality of make up water (softened or not) ____________

Frequency and quality of blow down water ____________

Discharge location of blow down water ____________

2. Is there a regular maintenance programme for boiler? ☐ Yes ☐ No

If yes, describe the methodology and the aims of the programmes ____________

____

____

3. Provide in the table below, the characteristics of air emission generated.

Pollutants Generated by the Boiler

Pollutants	Value at Start Up	Value at 30mins.	Value at 2 hours.
CO_2			
CO			
NO			
NO_2			
NOx *			
SO_2			
SO_3			
Sox **			
Dust			
Other			

* If showing results in mg or m^3, calculate concentration as NO
** If showing results in mg or m^3, calculate concentration as SO_2

[1] If more than one boiler is operated, please repeat the same procedure for each one separately.

4. What are the types of air pollution control equipment used to improve the boiler's stake emission quality?
____
____
____

5. Comments / Remarks ____
____

GENERATOR

6. Does the hotel operate a generator? ☐ Yes ☐ No

If yes, please state

Date of installation. ____________________

Total generated capacity (kVA) ______________

Type of fuel consumed ____________________

Sulphur content of fuel ______________

Average monthly fuel consumption __________

7. Average daily operational time ____

8. Is there a regular maintenance programme for boiler? ☐ Yes ☐ No

If yes, describe the methodology and the aims of the programmes ____________________
____
____

9. Has a noise reduction system been installed? ☐ Yes ☐ No

If yes, what type of system is it? ____

10. When and why is the generator operated? ____

11. Provide in the table below, the characteristics of air emission generated.

Pollutants Generated by the Generator

Pollutants	Value at Start Up	Value at 30mins.	Value at 2 hours.
CO_2			
CO			
NO			
NO_2			
NOx *			
SO_2			
SO_3			
Sox **			
Dust			
Other			

* If showing results in mg or m^3, calculate concentration as NO
** If showing results in mg or m^3, calculate concentration as SO_2

12. What are the types of air pollution control equipment used to improve the generator's stake emission quality? ____
____

13. Comments / Remarks ____
____

STACKS

14. What is the total number of stacks? ______________________

15.Fill in the table below; provide information concerning the stack condition.

Stack Condition

Stack	Location	Height	Diameter	Receives Emission From	Filtering Systems if any:
1	*North Corner*	*7m*	*0.5*	*Genorator*	*n.a.*

16. In the table below, provide information concerning the stack condition.

Stack Condition

Stack	Condition
1	*Damaged-Bad Condition*

17. Average height of the surrounding buildings or vegetation (meters) ______________________

18. Does the hotel conduct any stack emissions quality monitoring? ☐ Yes ☐ No

If yes, what is the frequency of monitoring? ______________________________

What are the substances monitored? ______________________________
____

OZONE DEPLETING SUBSTANCES

19.Does the hotel use chlorofluorocarbons? (CFC - usually in the chiller) ☐ Yes ☐ No

20.Does the hotel use halons (fire fighting equipment)? ☐ Yes ☐ No

21. Does the hotel use hydro chlorofluorocarbons (HCFC)? ☐ Yes ☐ No

ODORS

22. Have any odors been detected in the hotel? ☐ Yes ☐ No

If yes, write down the location(s) of such odors ______________________________

23. List the possible cause(s) of the detected odors ______________________________

24. Have any actions been undertaken to control such odors? ☐ Yes ☐ No

If yes, describe the measures undertaken to control odor emissions ______________________________
____
____

STORAGE TANKS

25. Does the hotel have any fuel storage tanks? ☐ Yes ☐ No

If yes[2], what is the content of the storage tank? ______________________________________

When was it installed? ________________________ Volume of the tank (m^3) _______________

Is it located above or below the ground? ___________ Annual amount stored (m^3) ____________

26. Does it have any ventilation valves? ☐ Yes ☐ No

27. Is there a regular leakage test for storage tanks? ☐ Yes ☐ No

How often is this test conducted? ______________________________

Describe the methodology used to conduct such tests ____
____

MITIGATION ACTION

28. What are the actions taken to improve stack emissions quality? _________________________________
____

29. What are the types of air pollution control equipment used? ____________________________________
____

LEGAL ISSUES

30. Does our hotel adhere to any air emission regulations? ☐ Yes ☐ No

31. Is there an institution conducting routine air quality inspections at the hotel? ☐ Yes ☐ No

If yes, write down the name of the institution? ____

How often does it conduct inspections? _______________________________

If applicable, what are the dates of the three most recent inspections? ____________________________

Write down any problems encountered during such inspections? _______________________________
____
____
____
____

Include, if available a photocopy of the most recent inspection results.

[2] Please repeat the same procedure for each generator operation at the hotel.

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