



# TRAINING MANUAL 2011



HOTEL  
ENERGY  
SOLUTIONS



## Energy Efficiency and Renewable Energy Applications in the Hotel Sector

Hotel Energy Solutions Official Partners



Supported by





**ENERGY EFFICIENCY AND  
RENEWABLE ENERGY APPLICATIONS  
IN THE HOTEL SECTOR**



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### **Hotel Energy Solutions (HES) Project Basics**

Full name: Excellence in Energy for the Tourism Industry – Accommodation sector: SME hotels (EETI)

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### **Hotel Energy Official Partners**



### **Project Supported by**



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## ABBREVIATIONS

AC	Alternating current
BMS	Building management system
CCHP	Combined cooling heating and power
CER	Certified Emissions Reductions
CDM	Clean Development Mechanism
CFL	Compact fluorescent light
CHP	Combined heat and power
CSR	Corporate Social Responsibility
DC	Direct current
DNA	Designated National Authority
EE	Energy Efficiency
EMS	Energy management system
EPBD	Energy Performance of Buildings Directive
FIT	Feed in tariff
GDP	Gross domestic product
GHG	Greenhouse gas emissions
GHP	Geothermal heat pump
GSTC	Global sustainable tourism criteria
HSPF	Heating seasonal performance factor
HVAC	Heating, ventilation and air conditioning
IPCC	Intergovernmental Panel on Climate Change
ISO	International Organisation for Standardization
JI	Join Implementation
KV	Kilovolts
KW	Kilowatts
KWh	Kilowatt hours
LED	Light emitting diode
LEED	Leadership in Energy and Environmental Design
LPG	Liquid petroleum gas
MJ	Mega joules
MtCO <sub>2</sub> -e	Million tonnes of carbon dioxide equivalent greenhouse gases
PPA	Power purchase agreement
PV	Photovoltaic
RE	Renewable energy
RETS	Renewable energy technologies
REEEP	Renewable Energy and Energy Efficiency Partnership
SMEs	Small and medium-sized enterprises
TBL	Triple bottom line
tCO <sub>2</sub> -e	Tonnes of carbon dioxide equivalent greenhouse gases
UNEP	United Nations Environment Programme
UNF	United Nations Foundation
UNFCCC	United Nations Framework Convention on Climate Change
USD	United States Dollars
V	Volts
VER	Voluntary emissions reduction
VISIT	Voluntary Initiative for Sustainability in Tourism

# 1 INTRODUCTION



## **HES E-TOOLKIT APPLICATION**

The HES e-toolkit and project description are found at the following URLs:

### **HES e-toolkit web page:**

<http://hes.e-benchmarking.org>

### **Hotel Energy Solutions web page:**

<http://www.hotelenergysolutions.net/>

## **OBJECTIVE OF THE SECTION**

This section provides an introduction to the HES-Project and briefly describe the e-toolkit. It describes the rationale and objectives of the project, and the different components of the e-toolkit. It also provides a brief introduction to work with the e-toolkit, and describes the objective of the manual, the targeted audience, and the supporting material that accompanies the manual.

### **Main concepts:**

- HES Project and rationale
- HES e-toolkit
- Accompanying supporting material
- Purpose of the manual
- Targeted audience
- Methodology
- Recommendations for trainers

## **1.1 WHAT IS THE HES PROJECT?**

The Hotel Energy Solutions project delivers information, technical support and training to help small and medium-sized (SME) hotels across the 27 European Union Member States to increase their use of energy efficiency (EE) and renewable energy (RE) technologies.

This will help reduce hotels' operational cost, while increasing their competitiveness and sustainability. It also contributes to alleviating the industry's impact on climate change. Hotel Energy Solutions assist hotels by delivering (among other things):



- HES e-toolkit: An innovative web-based application that offers energy use data analysis, decision-making support and recommendations for investing in EE and RE technologies, as well as a carbon foot print calculator.
- HES video and e-brochure: communication tools will be made available for use by the hoteliers in support of transmitting the importance of energy savings to their guests and staff.
- Supporting materials: research publications concerning the most suitable EE and RE technologies, practices and incentives available for hotels.

## 1.2 WHY ACT ON THIS?

While the hotel sector is one of the tourism industry’s largest employers and sources of economic revenue, it is also a highly resource-intensive sector. The EU Action Plan for Energy Efficiency (2006) identifies the tertiary sector, which includes hotels, as having the potential to achieve 30% savings on energy use by 2020. This is higher than potential savings from households (27%), transport (26%) and the manufacturing industry (25%). Almost half of the world’s hotels are located in Europe, and 9 out of 10 of these are SME hotels. Currently the SME hotels use of EE and RE technologies is far below its real potential, and the majority of these hotels rely on older, less efficient equipment.

Reducing CO<sub>2</sub> emissions by adopting up-to-date energy technologies can help boost the competitiveness and sustainability of these hotels. To increase their savings potential through the use of EE and RE technologies, SME hotels need information and technical support. These are being developed by the Hotel Energy Solutions project.

## 1.3 HES E-TOOLKIT

### 1.3.1 What is the HES e-toolkit?

The HES e-Toolkit enables Small and Medium Enterprises (SMEs)<sup>1</sup> in the accommodation sector to compare their current energy use to similar enterprises, and provides support in ranking practical and cost-effective energy efficiency (EE) and renewable energy (RE) investment options. It also provides the carbon footprint of hotels, aiming to have an impact in reducing the hotels’ energy consumption, their energy bills, and their environmental impact.

<sup>1</sup> SMEs EU Definition: Enterprises qualify as micro, small and medium-sized enterprises (SMEs) if they fulfil the criteria laid down in the Recommendation which are summarized in the table below. In addition to the staff headcount ceiling, an enterprise qualifies as an SME if it meets either the turnover ceiling or the balance sheet ceiling, but not necessarily both.

Enterprise Category	Headcount	Turnover or Balance sheet total	
Medium-size	< 250	≤ € 50 million	≤ € 43 million
small	< 50	≤ € 10 million	≤ € 10 million
micro	< 10	≤ € 2 million	≤ € 2 million

The e-toolkit is an interactive online resource that allows the hotels to:

- Assess the energy consumption and performance compared to a statistic average of European hotels of the same category;
- Measure the hotel's carbon emissions; and
- Calculate the return on investment of proposed EE and RE technology solutions based on the hotel's energy performance. The hotel manager can use the e-toolkit to track the hotel's progress over time, and verify results.

The HES e-toolkit is a user-friendly, web-based platform comprised of an energy-benchmarking tool and a decision support sequence, which provides assistance in evaluating carbon emissions and mitigation techniques through EE and RE investment options. It also includes information on best practices and capacity building materials, a carbon footprint calculator and a return on investment calculator.

### 1.3.2 Why use the Hotel Energy Solution e-toolkit?

The Toolkit will help hoteliers develop a strategy for reducing their energy consumption, their energy bills, and their environmental impact. It will help them to assess, act, develop a strategy, and monitor their efforts, as illustrated below.



Figure 1: Overview of the HES

### 1.3.3 What does the Hotel Energy Solutions e-toolkit provide?

#### Energy performance reports

An energy performance report gives an overview of the hotel's electricity consumption and renewable energy usage compared to similar European hotels. It also assesses the potential of energy consumption reduction. This tool has been set based on review and analysis of data available on energy use by hotels in Europe. The data was extracted from a selection of around 20 studies that provide information on energy use intensity in hotels.

#### Personalised energy technology solutions

The e-toolkit tailors the current energy saving opportunities with potential energy solutions. Case studies and statistics on the competitive business advantage, sound energy investments and best practices of other hoteliers are also provided. The tool provides recommendations in EE and RE applications in the hotel according to the hotel's characteristics, geographical location, main available natural resources, and easy-to-implement actions that could be useful for the hotel.

#### Carbon footprint report

The carbon footprint report is a useful tool to provide an estimation of the volume of CO<sub>2</sub> emitted according to the hotel's energy consumption, facility characteristics, and location.

#### Return on investment calculator

The return on investment calculator helps to evaluate the best investment choices for each energy technology solution based on specific inputs provided by the hoteliers. The tool assists the user in making informed strategic decisions regarding their EE and RET investments. The aim is to support the analysis of the cost-benefit implementation of these technologies.

### 1.3.4 Accessing the e-toolkit

To start using the e-toolkit, the user should:

- Visit: <http://hes.e-benchmarking.org>;
- Click on "*It's free! Get started*";
- Click on "**register**", located at the top of the page, and follow the instructions.

Please note that the user has to register online (only once and free of charge) to access the e-toolkit. Once registered, the user needs to login by entering his/her username and password, and the latter will be directed to the project overview web page.

The e-toolkit allows the user to create as many "projects" as desired. He or she can click on "Add project" to add one or more projects.

For every project there is a questionnaire to complete. The information provided are stored and saved for future consultations. The user has the possibility of saving a project, interrupting a session and continuing to work later on the same project, or to work on another project without losing the stored information.

### 1.3.5 Questionnaire

The HES e-toolkit requires the user to provide information on the characteristics, type and energy consumption of its hotel in order to use the tools and reports. The starting point of any project is a questionnaire that has to be filled for each project, and gathers information that is needed by the e-toolkit reports. This questionnaire is divided in 6 steps, as follows:

- The first step relates to general information about the project, such as the name, year of reference and country where the project is based.
- The second step gathers information on the hotel type (e.g. tourist hostel, motel, resort hotel, inn, and so on), the average occupancy and staffing of the hotel.
- The third step requests information describing the hotel's main characteristics, including the age of the facilities, construction system, climate conditions, hotel size, services and facilities.
- The fourth step compiles information on energy consumption (including the consumption of electricity and fuels), and the final use of this energy (e.g. lighting, air conditioning, etc.).
- The fifth part of the questionnaire focuses on information regarding existing renewable energy technologies installed in the hotel (if applicable), its final use, and the potential to install new renewable energy technologies in the hotel according to: available space for placing equipment, available renewable energy sources, and surrounding obstacles that could interfere with proper functioning of the equipment.
- The final part of the questionnaire gathers more detailed information on the characteristics the hotel related to preventing energy loss (e.g. insulation, temperature controls, etc.).

#### **Important note:**

Please note that some of the questions will ask to the user specific information on its energy consumption. For this reason it is advisable that the user gathers his/her energy bills before starting.

## 1.4 SUPPORTING MATERIAL

This training manual is accompanied by additional material:

- Training session supporting material (available for download at <http://hes.e-benchmarking.org>):
  - o Presentation slides;
  - o Training manual annexes containing additional material to supports the training sessions, additional information on technical issues (technology, financial products, benchmarks, etc.) and guidelines on how to use the e-toolkit.
- Web-based HES e-toolkit, including:
  - o A benchmarking tool that will assist SME hotels in assessing their energy use and efficiency;
  - o An energy technology solution report, which provides recommendations for EE and RE applications;
  - o An ROI calculator, which is a decision support tool that assists in evaluating EE and RE investment options; and
  - o A carbon calculator that provides the carbon footprint of a hotel.

### **Important Note:**

The HES Web page provides additional information on Energy Efficiency, Renewable Energy and Climate Change. This information can be accessed from:

*[www.hotelenergysolutions.net/](http://www.hotelenergysolutions.net/)*

This material can be copied or printed for disseminate to course participants.

## 1.5 PURPOSE OF THE MANUAL

### 1.5.1 Objective

This manual supports the use of the “Hotel Energy Solutions” (HES) e-toolkit, a web-based application that assists hotels with planning and investing in EE and RE applications. The HES e-toolkit aims to support SMEs in evaluating their baseline conditions and selecting energy investments that yield optimal business results.

The main goal of this training manual is to assist trainers with training and to raise the awareness of hotel decision-makers and staff about opportunities for applications and the use of EE and RE technologies and practices.

Although EE and RE technology deployment requires specialised technical knowledge and expert support, the information provided by the e-toolkit can create a basic foundation to assist decision-makers in evaluating and implementing more sustainable energy practices in daily operations.

### 1.5.2 Target audience

This manual is aimed at trainers who will train and assist a range of decision-makers, including:

- Administrators
- Managers and staff
- Hotel associations
- Organisations that promote sustainable tourism
- Relevant educational programmes
- Other groups engaged with the hotel sector

We hope that you find the report useful for training hotels in improving their energy management practices.

## 1.6 METHODOLOGY

### 1.6.1 How the manual is structured

As explained, this manual supports the use of the “Hotel Energy Solutions” (HES) e-toolkit. It is structured as a training programme with the following sections:

Section 1: Introduction	<ul style="list-style-type: none"> <li>• HES project description</li> <li>• HES e-toolkit description and rationale</li> <li>• Accompanying supporting material</li> <li>• Purpose of the manual</li> <li>• Methodology</li> <li>• Recommendations for trainers</li> </ul>
Section 2: Background Information	<ul style="list-style-type: none"> <li>• Energy, climate change and the hotel sector</li> <li>• EU Directive on energy performance in buildings</li> <li>• Energy use in hotels</li> <li>• Energy consumption benchmark for the hotel sector</li> </ul>
Section 3: Basics	<ul style="list-style-type: none"> <li>• Defining energy efficiency and renewable energy applications</li> <li>• Why investing in EE and RETs?</li> <li>• Understanding and reading energy consumption and utility bills</li> </ul>
Section 4: EE and RE opportunities in hotels	<ul style="list-style-type: none"> <li>• Defining and describing EE technologies</li> <li>• Defining and describing RE technologies</li> <li>• Describing behavioural strategies and considerations</li> </ul>
Section 5: Economics and Financial Analysis	<ul style="list-style-type: none"> <li>• ROI Analysis</li> <li>• Barriers and risk associated with investing in EE/RETs</li> <li>• Financing mechanisms</li> <li>• Incentives (feed-in tariff, carbon finance, Eco-labels)</li> </ul>
Section 6: Recommendations	<ul style="list-style-type: none"> <li>• Steps to develop EE and RE projects in hotels</li> <li>• Recommendations on how to market the hotel's efforts</li> </ul>
Section 7: Case studies	<ul style="list-style-type: none"> <li>• Case studies and details related to the benefits that hotels have received in practice</li> </ul>
Sections 8 to 11: Supporting information	<ul style="list-style-type: none"> <li>• Useful links</li> <li>• Glossary</li> <li>• Units and conversion factors</li> <li>• Other supporting information</li> </ul>

Each chapter starts with a 'Text box' that describes the part of the e-toolkit being covered, and the main objectives of the chapter. It describes the practical use of the e-toolkit's specific components for the hotel, and explains how to use them. This box aims to assist the trainer in referencing the main concepts in the chapter.

Additional detailed information related to each chapter is available in the annexes section.

## 1.7 RECOMMENDATIONS FOR TRAINERS

### 1.7.1 Trainer profile

This manual is designed to assist any trainer in training hotels to use the Hotel Energy Solutions e-toolkit. The training deals with energy efficiency and renewable energy applications at a management level rather than a technical level. If possible, it is useful for trainers to have basic experience in:

- Hotel sector management and energy assessments
- Working with SMEs as well as with senior management in hotels
- Communicating with people who have limited knowledge about EE and RE equipment

#### **Important Note:**

The trainer should be knowledgeable about adult learning principles to ensure success of the training and to meet the needs of the audience.

### 1.7.2 Course structure

Depending on the number of people attending the training, it may be useful to have more than one trainer to provide additional assistance to participants during the workshop exercises. In these cases, a good solution is to have one trainer with basic technical knowledge and one trainer with more detailed technical knowledge.

As part of the training, local specialists – such as companies that supply and install EE and RE technologies, energy consultants, or representatives from local municipalities – could be invited to make short presentations and participate in question and answer sessions. This would help the hotels participating in the training to network with specialists who could help them act on the results provided by the e-toolkit.

A suggested course agenda is provided in Annex II of this manual. The trainer can increase or reduce the number of hours, implement the course in more than one day, or amend the agenda, depending on the audience, time available or the need to cover additional or different topics. For example, the course could be extended to cover monitoring instruments and their practical demonstration during a facility visit. Facility visits to look at different types of equipment and assess their performance have been highly recommended by previous participants<sup>2</sup>.

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<sup>2</sup> Energizing Cleaner. Production A Guide for Trainers. UNEP. [www.uneptie.org/shared/publications/pdf/DTIx0922xBA-EnergizingCP.pdf](http://www.uneptie.org/shared/publications/pdf/DTIx0922xBA-EnergizingCP.pdf)



### 1.7.3 Course Evaluation

#### Determining participant expectations

It is important for the trainer to evaluate the course or workshop at the end of the session. Moreover, it is equally important to assess participant expectations at the outset of the training. This allows the trainer to emphasise information or discuss topics that participants have identified as important. The trainer can amend the agenda to accommodate participants' expectations where possible. For example, if participants know a lot about energy equipment, then more time can be spent on identifying areas for energy conservation, explaining case studies from other companies, or visiting a plant. In addition, determining expectations upfront makes it easier for the trainer and the participants to assess whether the expectations have been met.<sup>3</sup>

Expectations can be determined by asking each participant to complete a short questionnaire prior to the course, or by asking everyone to introduce themselves and explain what they hope to learn during the introductory session. It is important that the trainer write the expectations down. This can be done on a whiteboard or flipchart or on a separate sheet in the following way<sup>4</sup>:

Name participant	Hotel / City	Expectations from the course

#### Training evaluation

During the last session, the trainer can ask participants to reflect on how the course met their expectations using three questions:

- What was useful about the course?
- What could be improved or what was missing?
- What will be done with what was learned?

Then participants can be asked one-by-one to verbally explain their answers. The advantage of this method is that people can react to and reflect on each other's comments before giving their own views.

A trainer can get a good sense about the reaction to the course from the group as a whole. It is important to have written expectations from the beginning of the course at hand to be able to compare expectations with actual outcomes.

A sample evaluation form is provided in Annex III of this manual.

<sup>3</sup> Energizing Cleaner. Production *A Guide for Trainers*. UNEP. [www.uneptie.org/shared/publications/pdf/DT1x0922xBA-EnergizingCP.pdf](http://www.uneptie.org/shared/publications/pdf/DT1x0922xBA-EnergizingCP.pdf)

<sup>4</sup> Ibid.

## Training impact

The impact of the training course can be determined by evaluating what participants have applied in practice. In some instances, donor agencies that fund a course may require such feedback to justify funding future courses. For this reason, it is recommended to define an action plan for each course participant. The action plan can be used to find out how participants intend to use the information that they have learned.

After a certain period, e.g. three or six months, participants can be approached to provide feedback on the results of their planned actions. Results may include the action plans prepared by hotels that participated in the training, the EE and RE technology options identified, and potential or achieved financial and environmental savings<sup>5</sup>.

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<sup>5</sup> Energizing Cleaner. Production A *Guide for Trainers*. UNEP. [www.unep.org/shared/publications/pdf/DTIx0922xBA-EnergizingCP.pdf](http://www.unep.org/shared/publications/pdf/DTIx0922xBA-EnergizingCP.pdf)

## 2 BACKGROUND INFORMATION



### HES E-TOOLKIT APPLICATION

#### + HES Energy School: Climate change information

The HES website provides information and publications on climate change, such as:

- Advancing Tourism Response to Climate Change
- Renewable Energy – Power for a sustainable future

This information can be accessed and downloaded from the HES website, and is located under the “Energy school – climate change” tab at the menu bar.

<http://www.hotelenergysolutions.net/>

#### + e-toolkit: Energy related report

The HES e-toolkit provides a tool that assists hoteliers with assessing the hotel’s current energy performance, and compares it with a benchmark. The HES benchmarks have been set based on review and analysis of data available on energy use by hotels in Europe, and can help hoteliers make decisions that comply with local regulations.

### OBJECTIVE OF THE SECTION

The goals of this section are to provide an overview of the relationships between climate change, energy and the hotel sector; explain the concepts of energy security and sustainability; and define the role of EE/RETs. The section explains the energy consumption and related particularities of the hotel sector.

Main concepts:

- Energy, climate change and the hotel sector
- EU Directive on energy performance in buildings
- Energy use in hotels
- Energy consumption benchmark for the hotel sector

## 2.1 ENERGY, CLIMATE CHANGE AND HOTELS

The hotel sector is one of the most dynamic and fastest growing sectors in many countries, and it constitutes an important engine of the economy. Every day 10 hotels open somewhere in the World<sup>6</sup>. Europe has approximately 201,000 hotels (and similar establishments),<sup>7</sup> and 5.45 million hotel rooms, or nearly half of the world's total in 2005<sup>8</sup>. More than 90% of these enterprises are micro-enterprises, employing 10 people or less.<sup>9</sup> The hotel sector is one of the highest consumers of resources (including energy, water, and consumables) in the non-residential building sector, representing some 9% of total energy consumption in the commercial buildings sector.<sup>10</sup>

It is estimated that the total annual energy consumption in EU hotels in 2000 was 39 TWh, of which half was electricity.<sup>11</sup> This figure could be compared with Denmark's total 2008 annual electricity consumption of 34.3 TWh,<sup>12</sup> or Hungary's total 2010 annual electricity consumption of 42.7 TWh,<sup>13</sup> and it is equivalent to the energy stored in 23 million of barrels of oil.<sup>14</sup> This energy and resource consumption has important environmental impacts.

Buildings in the European Union account for 40% of total energy consumption and one third of CO<sub>2</sub> emissions.<sup>15</sup> The travel and tourism sector's current contribution to global greenhouse gas (GHG) emissions (excluding aviation) is estimated to be 3% of global emissions from human activities. Worldwide accommodation emissions make up more than 15% of the overall travel and tourism sector's footprint.<sup>16</sup>

The impacts of climate change are already being felt. In 2011, the EU experienced the driest three-month spell in more than 50 years, receiving just 25 to 60% of the long-term average rainfall since February.<sup>17</sup> There are concerns that some of Europe's nuclear reactors may be forced to temporarily close within months if there is no substantial increased in rainfall. Most of France's nuclear stations rely on river water for cooling, and falling levels of river water could force closure. Lack of snow, fires, and floods are becoming more frequent and more severe in most European countries.

Many tourist destinations are already experiencing climate-related impacts such as floods, extreme warm temperatures, less snow, shrinking glaciers, etc. For example, Ibiza experienced in 2011 its worst recorded forest fire, which damaged 2,000 hectares and forced the evacuation of 700 tourists.<sup>18</sup> Much tourism is concentrated in high-energy intensive environments, such as

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<sup>6</sup> IHRA statistics

<sup>7</sup> Similar establishments: include hotels, apartment hotels, motels, roadside inns, beach hotels, residential clubs, rooming and boarding houses, tourist residences and similar accommodation.

<sup>8</sup> Eurostat – European Business Facts and figures 2006 edition. Page: 322

[http://epp.eurostat.ec.europa.eu/portal/page/portal/product\\_details/publication?p\\_product\\_code=KS-BW-06-001](http://epp.eurostat.ec.europa.eu/portal/page/portal/product_details/publication?p_product_code=KS-BW-06-001)

<sup>9</sup> Comprehensive sectoral analysis of emerging competencies and economic activities in the European Union Lot 12: Hotels and restaurants, April 2009. Page 22

<sup>10</sup> Power Quality & Utilization Guide, Hotels – Leonardo Energy. Niki Hendriks.

<sup>11</sup> CHOSE Project, Energy Savings by Combined Heat Cooling and Power Plants (CHCP) in the Hotel Sector.

<http://www.inescc.pt/urepe/chose/results.htm>

<sup>12</sup> The world factbook- [www.cia.gov](http://www.cia.gov)

<sup>13</sup> Ibid.

<sup>14</sup> The barrel of oil equivalent (BOE) is a unit of energy based on the approximate energy released by burning one barrel (42 US gallons or 158.9873 litres) of crude oil.

<sup>15</sup> Directive 2010/31/EU

<sup>16</sup> Towards a Low Carbon Travel & Tourism Sector, WEF. Thea Chiesa and Amit Gautam May 2009.

<sup>17</sup> <http://www.guardian.co.uk/environment/2011/may/31/europe-dry-spring-power-blackouts>

<sup>18</sup> <http://www.inmonova.com/es/incendio-en-ibiza-2011>

along coasts and in mountains, where changes in frequency and magnitude of climate-related phenomena can have big economic implications.

Climate change is one of the greatest threats facing our planet and is affecting the way companies do business. Businesses today are under external scrutiny like never before, which will continue to impact the hotel sector in the coming years. Hotel will increasingly need to implement more efficient and environmentally preferable practices.

Major global travel societies such as National Geographic, TUI AG, or Thomas Cook are more often using environmental sustainability as a key measure in their rankings of international travel destinations.<sup>19</sup>

In terms of energy security and prices, the EU is highly dependent on imported oil. It is estimated that by 2030, the EU will be 90% dependent on imported oil and 80% on imported gas.<sup>20</sup> It is impossible to predict the price of oil and gas in 2030, but there is no doubt it will be significantly higher than today, especially if demand from the developing world continues to grow at its current pace. Energy prices have a considerable impact on the hotel sector, as energy generally makes up the largest portion of hotel operational cost after the cost of staff.

## 2.2 EU DIRECTIVE ON THE ENERGY PERFORMANCE OF BUILDINGS

The EU has set the objective of a 20% increase in the share of renewable energy, a 20% reduction in GHG emissions, and a 20% reduction in energy consumption by 2020.<sup>21</sup> The energy performance of buildings is key to achieving the EU Climate & Energy objectives. According to the EU, buildings are responsible for 40% of total energy consumption and 36% of total EU CO<sub>2</sub> emissions.<sup>22</sup> Improving the energy performance of buildings is a cost-effective way of combating climate change and improving energy security while also creating job opportunities, particularly in the building sector.

The Directive on Energy Performance of Buildings, EPBD - (2002/91/EC), is the most important legislative tool in Europe for addressing energy consumption in buildings. The directive came into force in 2006 and requires EU member states to comply with:

- a) Minimum Energy Performance Standards
  - A methodology for the calculation of the energy performance of buildings
  - Minimum energy performance standards for new buildings, and for large existing buildings subject to major renovation
  - Energy certification of buildings
  
- b) Energy Performance Certificates
  - To be provided to prospective purchaser/tenant
  - Must be prominently displayed in all public buildings and institutions providing public services (e.g. hotels)

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<sup>19</sup> Green Tourism A Road Map for Transformation, bozz&co. Dr. Jürgen Ringbeck, Amira El-Adawi, Amit Gautam

<sup>20</sup> European University Institute. [www.eui.eu/RSCAS/WP-Texts/03\\_09.pdf](http://www.eui.eu/RSCAS/WP-Texts/03_09.pdf)

<sup>21</sup> [http://ec.europa.eu/clima/policies/package/index\\_en.htm](http://ec.europa.eu/clima/policies/package/index_en.htm). European Commission - Climate Action.

<sup>22</sup> European Commission, research and innovation; [http://ec.europa.eu/research/industrial\\_technologies/eeb-challenges-ahead\\_en.html](http://ec.europa.eu/research/industrial_technologies/eeb-challenges-ahead_en.html)

- c) Regular inspection of boilers, air-conditioning systems, and assessment of heating systems with boilers that are more than 15 years old.

This directive has a direct influence on the hotel sector, as it requires minimum energy requirements for:

New buildings:	Must meet energy performance requirements and feasibility study on renewable energy, cogeneration, district block heating or cooling, and heat pumps.
Buildings undergoing major renovations:	Whenever an entire building, or an element of it, undergoes major renovation, <sup>23</sup> its energy performance is upgraded to meet minimum requirements and must encourage the consideration of alternative systems for heating.
Technical building systems:	Governments must mandate system requirements for new installations, as well as replacement and upgrading of technical building systems installed in existing buildings. This covers inter alia heating, hot-water, air-conditioning and large ventilation systems, and any combination of such systems. Encouragement of intelligent metering systems, automation control and monitoring systems is required.

More information and some examples of national responses to the Directive on Energy Performance of Buildings are provided in Annex IV.

## 2.3 ENERGY USE IN HOTELS

### Important Note:

The e-toolkit can assist hotels in understanding their energy use, and can provide recommendations for improving the energy performance of the facilities to comply with local regulations under the 'Energy Performance of Buildings Directive.'

Energy generally makes up the largest portion of hotel operating costs after the cost of staff. Energy consumption depends on a variety of factors, including (but not limited to) facilities provided, category of hotel, occupancy, geographical situation, weather conditions, nationality of clients (which correlates with consumption habits), architecture of the building, and design and control of installations. Consumption is especially influenced by the source of energy, depending on the local policies of energy prices and services of energy companies.

<sup>23</sup> When defining a "major renovation" the EPBD says that governments must opt for either work in excess of 25% of the building value less intrinsic land value, or 25% of the surface building envelope".

Water heating and hot water usage are a substantial percentage of total energy consumption in hotels. The following chart (Figure 2) shows the results of an analysis of over 50 detailed energy surveys of hotels in England. In terms of cost, heating and lighting represent half of the total energy costs of the hotels.

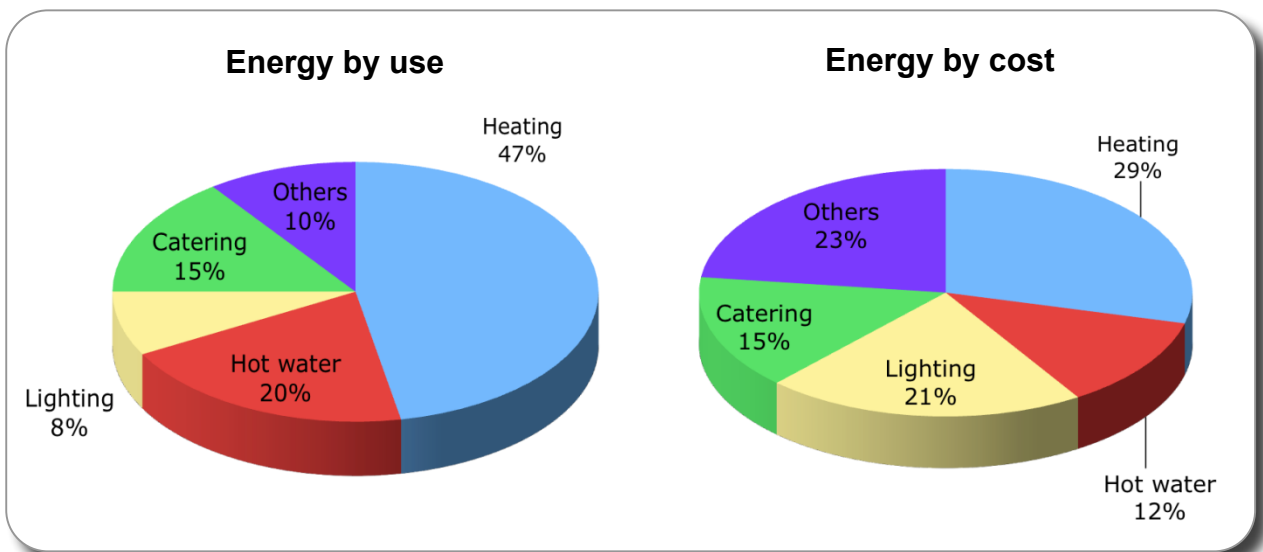


Figure 2: Analysis of delivered energy in a hotel in England by use and cost<sup>24</sup>

Figure 3 shows a similar example from a hotel in Greece.

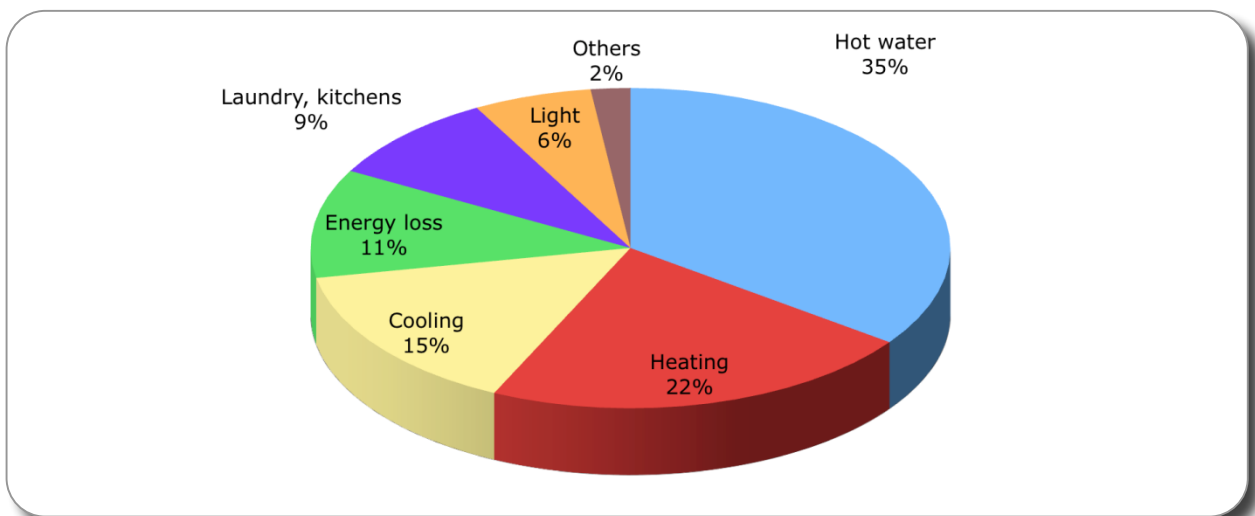


Figure 3: Analysis of delivered energy in a hotel in Greece by use<sup>25</sup>

There is a strong business case for adopting energy efficiency (EE) and renewable energy (RE) technologies in the hotel sector. One contributing factor is the fact that environmental considerations are becoming increasingly important to hotel guests. EE and RE technologies can have a direct impact in reducing energy consumption and environmental pollution. By doing so, they increase the competitiveness of the sector and support the energy security of

<sup>24</sup> Energy Efficiency in Hotels - A Guide for Owners and Managers, Guide 36. Carbon Trust

<sup>25</sup> Evaluation of the Energy Consumption in Mediterranean islands Hotels: Case study: the Balearic Islands Hotels

the broader economy. The use of EE and RE reduces CO<sub>2</sub> emissions, the main greenhouse gas responsible for climate change.

## 2.4 ENERGY CONSUMPTION BENCHMARK FOR THE HOTEL SECTOR

### **Important Note:**

The HES e-toolkit provides a tool that assists hoteliers in assessing the hotel's current energy performance, and compares it with a benchmark. The HES benchmarks have been set based on review and analysis of data available on energy use by hotels in Europe.

The benchmarks and values presented on energy consumption and carbon emissions in the hotel sector are useful for comparing and evaluating a hotel's energy and emissions performance with other hotels and with sector standards, energy performance regulations, and competitors. Unfortunately, every analyst has a different way of evaluating benchmarks, and the values presented can vary significantly depending on the parameters and calculations used.

The HES e-toolkit benchmarks have been set based on review and analysis of data available on energy use by hotels in Europe. The data was extracted from a selection of around 20 studies that provide information on energy intensity in hotels, and which were identified from 80 reports on hotels and energy issues, located through a review of the relevant literature and web searches.

This indicates that, for most hotels, energy use falls in the range 200-400 kWh/m<sup>2</sup>/yr. This is consistent with the main range of energy performance differentiation in published energy benchmarks (e.g. set by Accor for its hotel brands; by the Nordic Swan scheme; by the LowE project; by WWF/IBLF; and by the Thermie programme), which is also between 200-400 kWh/m<sup>2</sup>/yr.

Combining data from available studies and performing a statistical meta-analysis indicates that average energy use by hotels is in the range 305-330 kWh/m<sup>2</sup>/yr. The data indicate large variations in energy use levels. Overall, it is apparent that the variation between the hotels within each sample is far greater than the differences between the averages for different samples. There is no evidence that there are any statistically significant differences in levels of energy use intensity (kWh/m<sup>2</sup>/yr) between hotels or other accommodation with different star ratings.

The analysis also indicates that kWh/m<sup>2</sup>/yr is a more widely reported and useful comparative measure of energy use levels than kWh/guest-night, given that the latter measure is susceptible to large variations due to changes in hotel occupancy levels in different years as well as variations in room sizes between different grades of hotel (although it is useful for managers



when considering business performance). There was insufficient data to derive benchmark values for kWh/guest-night (and given the variations to which this measure is subject, benchmarks for this measure would be of limited comparative value in any case).

The HES benchmarks have been set based on quintiles of the data from the meta-analysis referred to above, and are as follows:

**Table 1. Energy consumption per year and per m<sup>2</sup>**

	Range	kWh/m <sup>2</sup> /year	Quintiles
Excellent	< 195 kWh/m <sup>2</sup> /year	195	20%
Good	195 - 280 kWh/m <sup>2</sup> /year	280	40%
Average	280 - 355 kWh/m <sup>2</sup> /year	355	60%
Poor	355 - 450 kWh/m <sup>2</sup> /year	450	80%
Very poor	> 450 kWh/m <sup>2</sup> /year	>450	

Other points to note are that overall energy use levels can be relatively constant (except in the most extreme climatic zones), because the reduced need for heating during some seasons is balanced by increased use of air conditioning during others. Although increases in energy for heating and for cooling (and vice-versa) balance out over quite a wide climatic range, there will be significant differences in the necessary technologies to reduce energy use in different climatic zones.

The e-toolkit Energy Report shows and benchmarks energy use intensity (measured in kWh/m<sup>2</sup>/yr) for each hotel. It also shows, but does not benchmark, both kWh/guest-night and kWh/guestroom/year as these are useful measures for managers when considering business performance.

For more information on the HES e-toolkit energy related report, refer to Annex I: e-toolkit Users Manual.

## 3 BASICS



### HES E-TOOLKIT APPLICATION

The first step to using the HES e-toolkit is to fill out a questionnaire that gathers information about characteristics of the hotel. This information is used to provide recommendations and assess the hotel's energy consumption. The questionnaire helps take into account all the considerations that are relevant for installing and implementing EE and RE technologies.

The questionnaire can help hoteliers keep track of the energy performance of the hotel as the information is stored in the system. The questionnaire has to be filled in every time a new project is generated in the system.

The e-toolkit provides a report with recommendations on energy solutions. This report provides recommendations for EE and RETS solutions according to the information that was entered in the questionnaire. It provides recommendations for thermal energy, for electricity. It provides recommendations that require both small investments and larger investments. These recommendations can be useful to the hotel for implementing an action plan to save energy and reduce environmental impact.

### OBJECTIVE OF THE SECTION

The goals of this chapter are to define EE and RE, discuss relevant considerations for implement these technologies, and explain the reasons for hotels to invest in EE/RETs. The chapter also provides useful information on how to read and understand utility bills.

Main concepts:

- Defining energy types
- Why invest in EE and RETs?
- Understanding and reading energy consumption and utility bills

## 3.1 DEFINING EE AND RE APPLICATIONS

### 3.1.1 Energy types

In the hotel sector, two types of energy are used: thermal energy and electricity.

Thermal energy is primarily used for cooking, space and water heating. It can come from various energy sources, such as gas, diesel, or oil; or it can be generated from renewable sources such as solar or biomass.

Electricity is used in a wide range of applications, including lighting, powering appliances, cooling, heating, communications, etc. It can be bought from the grid or it can be generated (fully or partially) from conventional sources – diesel generators, gas microturbines – or from renewable sources – solar photovoltaic panels, wind, hydropower, etc.

In both cases, it is desirable to have an efficient use and generation of energy. Figure 4 shows typical breakdown electricity and thermal energy consumption in a hotel.

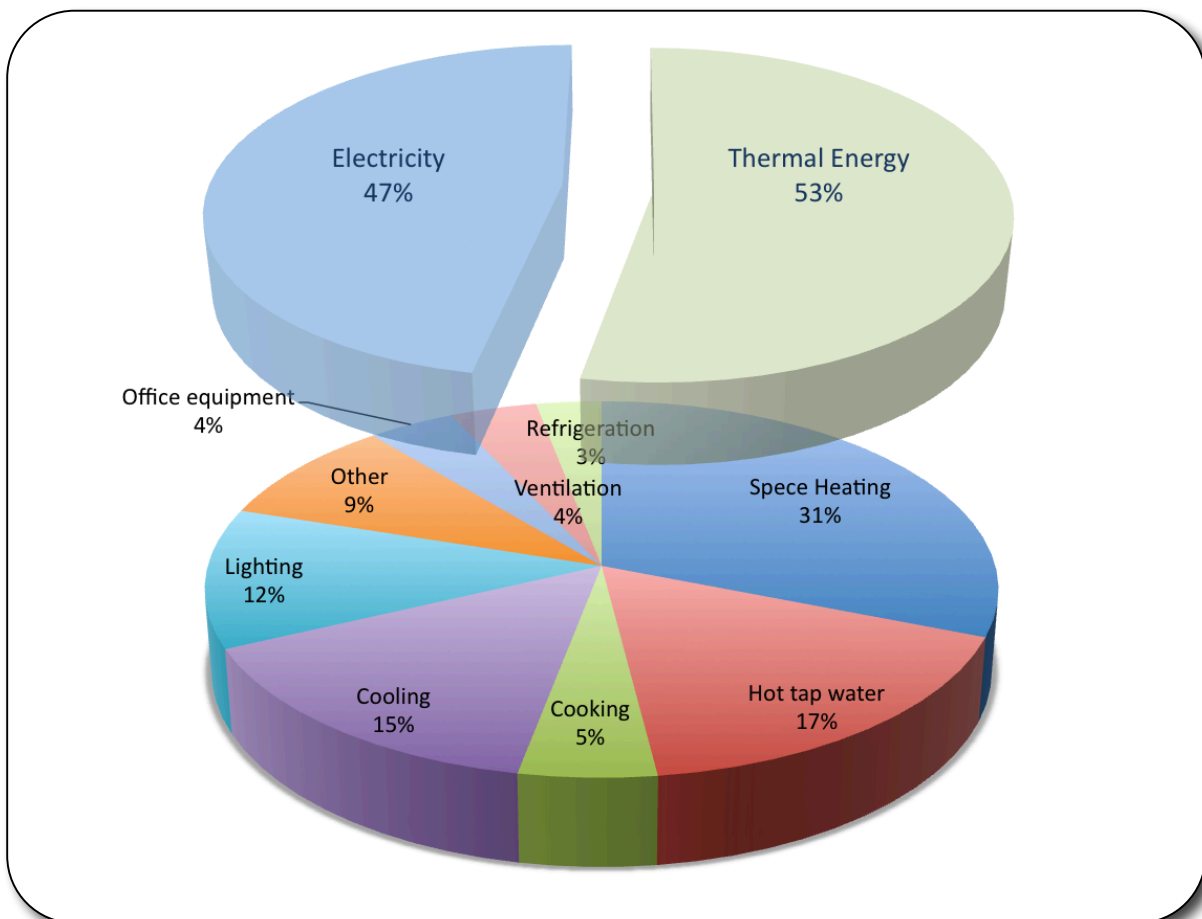


Figure 4: Total Energy Consumption by End Use in a Hotel<sup>26</sup>

<sup>26</sup> Energy Efficient Hotels, Niki Hendriks. Laborelec. November 2008. [www.leonardo-energy.org](http://www.leonardo-energy.org)

Renewable Energy (RE) sources like wind or solar are unlimited, as they capture energy flows available from the natural environment that cannot be depleted. Hotels can generate at least part of the energy consumed from renewable sources. A non-renewable resource is a natural resource which cannot be produced, grown, generated, or used on a scale which can sustain consumption rate over the long-term, implying that the sources are limited and susceptible to depletion. Examples include petroleum, carbon, and natural gas.

Energy Efficiency (EE) means using less energy to perform the same tasks and functions. For hotels, this could mean reducing the amount of energy needed for heating by improving insulation of the hotel building, by introducing lighting control, or by regulating space heating and cooling.

### **3.1.2 Important considerations for implementing EE and RET**

Some important considerations for hotels when evaluating a renewable energy system:

- Availability of the electricity grid, or fuel supply. In the case of an existent electricity grid (on-grid) or a reliable fuel distribution system, meaning that it is possible to purchase electricity or fuel from an energy provider, it is important to determine the following:
  - o The price of the energy supply: This will influence the relative cost-effectiveness of implementing a sustainable energy system.
  - o The reliability and quality of the energy supply: This could influence the decision made depending on whether installing renewable energy systems will improve the functionality of and benefits obtained from the energy supplier.
  - o In the case of electricity, possibility to sell electricity to the grid: This could influence the investment decision regarding a renewable energy system because it offers the possibility of increasing the profitability of the investment by selling excess electricity to the grid.
- In the case of an off-grid situation, meaning there is no option of being connected to an existing electricity grid, the considerations related to implementing an RE system change substantially.
- It is important to assess the availability of renewable energy resources because RE technologies depend on the availability of those resources locally. For example, solar photovoltaic systems and solar water heaters are powered by sunlight, and micro-hydropower is dependent on easy access to flowing water.
- The hotel must have the appropriate space to allocate the RE systems, and sometimes the systems have to be integrated into the building design (e.g. façade and outdoor areas).

- It is important to understand the practical limitations of different RETs.
- It is important to understand local regulations to build and use RETs, and to be aware of possible local incentives (e.g. tax incentives, feed-in tariffs, soft loans).
- It is important to have an energy efficiency plan before considering an RE project.
- It is important to understand the hotel's current energy use, including energy type, overall consumption and fluctuations in demand. This can be determined by a load profile. The load profile is a graphic that shows how energy demand changes with respect to time. Hotels experience different energy demand at noon and at night, in summer and in winter. The load profile is important for choosing the size of the renewable energy systems and the type of energy storage components. It will also affect the efficiency and cost-effectiveness of the RE system.

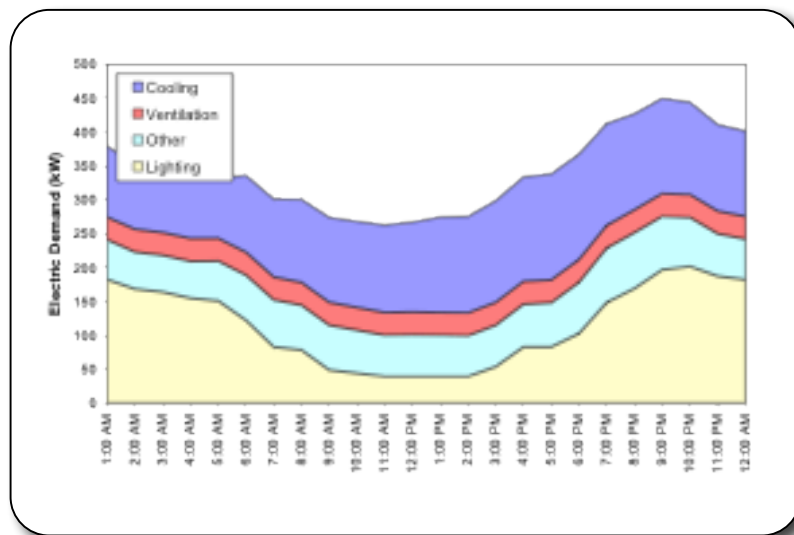


Figure 5: Typical Hotel Electricity Load Profile in one day<sup>27</sup>

- It is important to know the energy mix that the hotel will require. Some RETs can generate either electricity or heat, while others can generate both.
- It is important to carry out a feasibility study to assess the technical, economic and environmental performance of the energy improvements. The hotel should conduct a feasibility analysis of different options for providing energy to its facilities, ranging from using renewable energy technologies to upgrading to more efficient fuel generators.
- It is important to find accredited EE/RE installers and certified products. Normally, in each country in Europe, there is an association of renewable energy or energy efficiency that groups the local suppliers and project developers.

<sup>27</sup> National Action Plan for Energy Efficiency Sector Collaborative on Energy Efficiency Hotel Energy Use Profile

The selection of the technology will therefore be determined by a number of factors that need to be assessed before considering which of the technologies will be suitable. These include:

- Availability of renewable natural resources
- Climate, location, and topography
- Scale of generation required (size does matter)
- Potential cost of installation, operation, and maintenance
- Potential availability of financing and support
- Local regulation or building codes
- Availability of skilled people locally to install and maintain the technology
- Existing building and facilities – technical challenges and issues
- Getting local energy suppliers to agree to the project

### **Difference between Power and Energy<sup>28</sup>**

It is very common, when referring to an RE technology, to talk in terms of power (e.g. KW) and energy (e.g. KWh), and it is important to understand the difference. These two terms are often confused.

Energy helps us do things. It gives us light, warms our buildings, runs our TVs and our cars. Energy is the ability to do work, and is normally measure in kilowatt hour (KWh), BTU, or joules (J).

Power is the rate at which energy is generated or used. So power is a measure of how fast something is generating or using energy.<sup>29</sup> The higher the KW capacity of an RE device, the faster that equipment is generating energy.

For example, to refer to the size of a wind turbine, one can identify the "power" (KW) that is specified in the manufacturing manuals and refers to the rate at which energy is produced by this turbine. It is necessary to calculate the number hours that the wind turbine would be working (transforming wind into electricity), and the average wind speed, in order to calculate the "energy" produced (KWh).

At the end of this manual there is a section on "Units and conversion factors" (Chapter 11) to facilitate calculations.

### **3.1.3 Energy systems components**

Successful development of sustainable energy systems requires taking into account three fundamental components: energy generation, energy use, and the behaviour of relevant people.

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<sup>28</sup> <http://www.facstaff.bucknell.edu/mastascu/elessonshtml/Basic/Basic6PE.html>

<sup>29</sup> <http://www.energylens.com/articles/kw-and-kwh>

- ENERGY USE: Always try to reduce energy before investing resources in producing it with cleaner technologies. Ensure the equipment within a facility uses the least amount of energy necessary to provide the desired services.
- ENERGY GENERATION: Producing energy more sustainably using renewable energy and low-impact energy supply technologies.
- PEOPLE'S BEHAVIOUR: Changing/improving the behaviour of users, and operating equipment in the most effective way to limit unnecessary energy use and maximise the benefits of the technology being used.

### 3.2 WHY INVESTING IN EE/RETS?

Implementing EE and RE technologies in hotels is fundamental for the sustainable development of the hotel sector, and there are several important benefits:

- a) Investments in EE and RE applications can significantly reduce operating costs and energy consumption, with relatively short payback periods (see Chapter 5, 'Economics and financial analysis').
- b) Energy efficiency and conservation practices can improve a hotel's reputation among guests and others, and assist the hotel in maintaining and expanding its number of loyal clients (see Chapter 6, 'Developing EE/RET projects in hotels').
- c) Energy represents the single fastest growing operating cost in the hotel sector. Using EE and RE can significantly reduce the risk of economic impact due to an unexpected energy shortfall or cost increase.
- d) Implementing EE and RE applications can keep the facility secure and safe from environmental and climate change liability concerns.
- e) The hotel will be seen as an energy leader and "green" business in the sector, attracting interest and promoting the hotel. The publicity generated through poor practices may undermine the reputation of the hotel, causing operating losses. Good practices, however, can be an effective marketing tool as an increasing number of guests seek environmentally and socially responsible hotels.
- f) Using EE and RE can reduce environmental impact, maintaining the quality of the destination and improving guest experience.
- g) In terms of asset value, investing in EE and RE technologies increases the market value of the building/facilities
- h) EE and RE applications imply that much better energy management, monitoring, verification, and controlling procedures are in place, and this in turn aids in the identification of energy problems, often before the most costly events occur. This means problems can be addressed before they result in guest complaints.

- i) Better energy management due to EE and RE implementation can extend equipment life, deferring replacement costs for years to come.

The cost of energy for a hotel can be a substantial portion of total operating costs and one of the largest elements of expenditure, representing up to 20% of a hotel's total operating costs.<sup>30</sup>

Every euro saved as a result of reduction in energy consumption directly contributes to the bottom line of the hotel and increases profits, thereby improving competitiveness. Savings derived from a hotel property's energy budget can be reinvested elsewhere. It is often easier to increase the profitability of a business by reducing costs than by increasing sales or turnover.

In terms of investment, EE and RE technologies can provide a predictable cash flow and can offer substantial clarity for making strategic financial decisions. It is easier and more accurate to predict expenses and profits from EE and RE investments than, for example, from an investment in a new swimming pool or the refurbishment of a lobby, where it is very difficult to predict the resulting profit or potential income increase.

In many cases, EE and RE applications can reduce energy and operation expenses, with attractive investment returns. In addition, payback periods are relatively short and technology risks are low (See table 3). The profits obtained from this "low risk" investment could allow hotel owners and administrators to reinvest this money in other priority areas.

**Table 2. Identification of savings measures in 400 beds hotel at the Balearic's Islands.**<sup>31</sup>

EE and RE applications	Invest	SAVINGS per year			Payback
	€	MWh	Kg CO <sub>2</sub>	€	years
Change electricity company conditions	6977	0	0	5312	1.31
Reduce Refrigeration losses and frost control	492	13.4	3.8	828	0.6
Rational regulation	600	14	4	863	0.7
Isolation improvement	264	21.5	6.2	1327	0.2
Thermodynamic valves	2338	22.5	6.5	1393	1.68
Lighting regulation	12	23.7	6.8	1467	0.01
Improving of boilers	345	28.7	8.3	1773	0.19
Control of Hot water and calefaction	163	52	15	3217	0.05
Heat recovering/water condenser	3750	106	30.5	6551	1.03
Change source of energy	18000	144.5	41.6	8937	2.01
Change of bulbs and electronics	230	197.6	56.9	12214	0.02
Solar Energy use for hot water	124000	312.2	89.9	19304	6.42
<b>TOTAL</b>	<b>157,171</b>	<b>936.1</b>	<b>269.5</b>	<b>63,186</b>	<b>2.49</b>

<sup>30</sup> Tourism and Carbon Finance : potentials and challenges in the Caribbean Myriam LeBlanc – Development Director October 15 2010

<sup>31</sup> Evaluation of the Energy Consumption in Mediterranean islands Hotels: Case study: the Balearic Islands Hotels. 2003, page 4: A. Moiá-Pol, Michalis Karagiorgas, D. Coll-Mayor, V. Martínez-Moll, Carles Riba-Romeva



The above table, Table 3, shows the energy savings and payback periods associated with different actions in a representative hotel of 400 beds in the Balearic's Island, built during the 1970's. This hotel consumes around 936 MWh of energy per year. The table shows that improving boilers can have a very fast payback period, and energy savings of 33% (312.2 MWh) can be reached simply through the installation of solar collectors. It further shows that changing the source of energy can increase the energy savings to 48% (additional 144.5 MWh). Analysing the payback period of the different actions reveals that most of the investments have a payback period of less than two years.<sup>32</sup>

Although water is not a primary focus of this training manual, it is important for hotels to consider water efficiency as part of the energy efficiency strategy. Water savings can have a direct impact on reducing electricity and thermal energy consumption; less use of water implies less use of water pumps, and less use of thermal energy to heat it. When water efficiency is added to energy-efficiency opportunities, the benefit could be larger and more attractive to the hotel.

The Intergovernmental Panel on Climate Change (IPCC) estimates that, by 2020, about 29% of emissions in commercial buildings (including hotels) can be eliminated cost-effectively with EE solutions.<sup>33</sup> Implementing EE measures and RE applications has strong implications for reducing the use of fossil fuels, reducing emissions, and increasing energy security.

### 3.3 UNDERSTANDING AND READING ENERGY CONSUMPTION AND UTILITY BILLS IN HOTELS

#### 3.3.1 Energy pricing

Understanding energy tariffs and how energy is priced is important for any business and can save the hotel money.

The energy tariff varies widely from country to country, and may also vary significantly from locality to locality within a particular country, as well as from customer to customer, depending on the nature and needs of the enterprise (whether industrial, household, or a hotel). The energy tariff varies depending upon where the hotel is located, how much energy is used, what type of meter the hotel has and the supplier the hotel chooses. There are many reasons for these differences in price, such as:

- **Type of customers.** Customers are categorised according to common, shared characteristics, such as the connection to a given voltage level and the type of customer – e.g. residential, small commercial, or industrial.
- **Time of use/seasonal charges.** This applies generally to electricity, where the price could vary depending on when the electricity is used – including the time of day, day of

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<sup>32</sup> Evaluation of the Energy Consumption in Mediterranean islands Hotels: Case study: the Balearic Islands Hotels. 2003, page 4: A. Moiá-Pol, Michalis Karagiorgas, D. Coll-Mayor, V. Martínez-Moll, Carles Riba-Romeva

<sup>33</sup> WEF 2009, Towards a Low Carbon Travel and Tourism Sector, p. 3

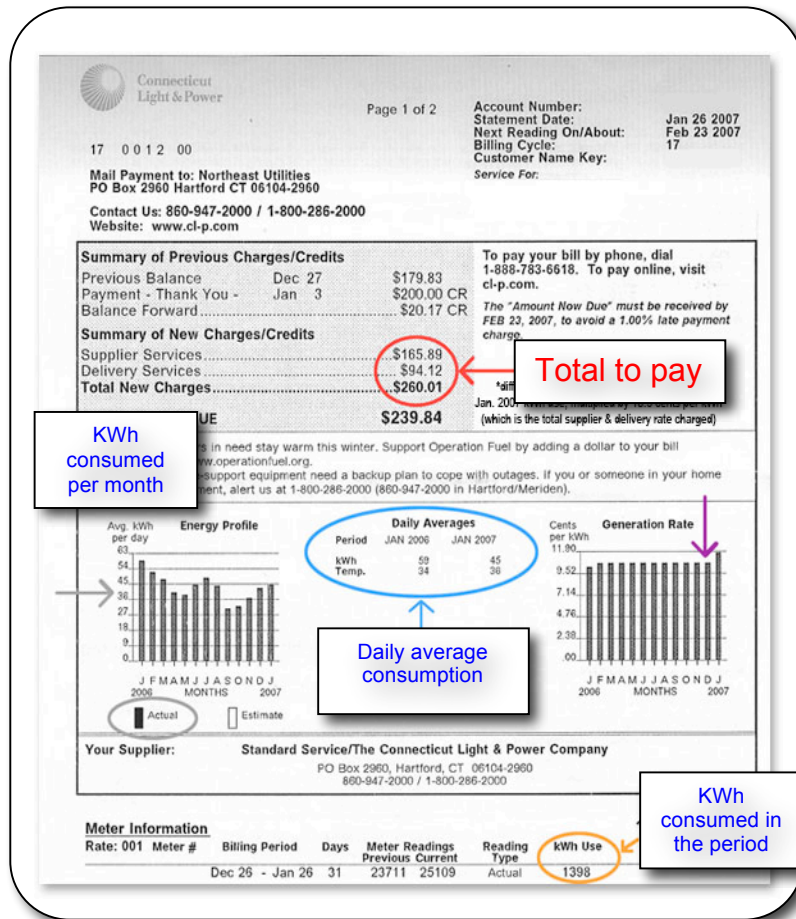
the week, and season of the year (particularly summer or winter). This is because there are periods of time when the electricity demand is significantly higher than the average supply level, and meeting this electricity demand is especially costly for electrical utilities. For this reason, some utilities have implemented smart meters that track how much electricity has been used and when, and have “time of use” rates. When using smart meters, the hotel can pay more for usage during business hours but much less for usage in the night-time and on weekends.

- **Usage.** The more energy a hotel consumes the higher the electricity tariff will be, so there is always an incentive to use less power. Large, energy-intensive consumers, such as mining or cement companies, are generally able to negotiate the energy price and annual consumption with the utility.
- **Location.** Energy prices usually differ depending upon where the hotel is located. For example, if the hotel is located in an urban area, it will generally pay a lower supply charge per day and usage price per kWh than a hotel that is located in a rural area. This difference reflects the fact that it costs less to supply a hotel in a big city compared to the countryside. In the city, population is more concentrated and the distances between customers are shorter, so the costs to supply electricity are lower.
- **Global energy market.** Energy prices are normally set in part by the price of energy in the global market. Most of the EU countries are highly dependent on oil imports, and are vulnerable to the volatility of global energy prices. Global geopolitics, increases in demand and the depletion of oil reserves are major factors affecting the final electricity or fuel price paid by the user.

### 3.3.2 Reading the energy bill

Learning how to read the energy bill is important for monitoring the hotel's energy usage. Though each energy company uses its own billing formats, most bills contain much of the same information.

Figure 6: Electricity bill sample<sup>34</sup>



Some recommendations:

- Energy companies will sometimes provide a guide to help customers read the energy bill. It is important to find the guide on the bill and use it to determine exactly what each entry means.
- The hotel's bill should have two readings: the current usage reading and a previous usage reading. These readings would have been documented by an energy company employee who came out to read the energy meters (electricity, gas, and hot water). Normally, the readings are recorded using Kilowatt-hours (KWh) for electricity, and

<sup>34</sup> <http://www.inetgiant.com/Tags/Electricity-Bill>

joules, BTU, KWh, etc. for thermal energy, which are then billed using the rates provided.

Some information on energy bills will vary depending on the energy company. In general, however, the bill is likely to contain information similar to the sample bill described below, including:

- Meter reading (taken by the company, supplied or estimated). This is normally in KWh for electricity and BTU or KWh for gas;
- Unit price, electricity tariff per KWh or fuel costs (e.g. BTU, KWh, kg);
- Additional charges (such as standing orders) and discounts;
- And sometimes the average daily use or historic energy consumption compared with energy consumption during the billing period.

**Important Note:**

The e-toolkit will request information about the hotel's annual energy consumption, so it is important for the hotelier to gather receipts covering the last 12 months and use these to identify the energy consumption and energy price.

## 4 EE & RE TECHNOLOGIES AND BEHAVIOURAL CHANGE



### HES E-TOOLKIT APPLICATION

The HES e-toolkit provides a useful compendium of fact sheets with detailed information on EE and RE technologies. These fact sheets can be downloaded from <http://hes.e-benchmarking.org/index.html>.

To access this information, select “*applications component*” on the menu bar, then select “*learn more...*”, and finally “*technological solutions sheets*”.

In addition to the technical solutions sheets, further information regarding RE and EE is provided in the “energy school” section on the HES project website <http://www.hotelenergysolutions.net/>.

### OBJECTIVE OF THIS SECTION

The goal of this chapter is to provide an overview of RE and EE technologies that are suitable for the hotel sectors, and to raise awareness about the importance of changing people’s behaviour.

Main concepts:

- Energy efficiency
- Renewable energy technologies
- Behavioural strategies and considerations

## 4.1 ENERGY EFFICIENCY TECHNOLOGIES

This section briefly describes energy efficiency technologies that can be relevant for a hotel facility. Further information about these technologies is provided in annex V.

### **Energy saving light bulbs**

Lighting is one of the largest areas of electrical energy consumption in hotels, as in many other kinds of buildings. Depending on the category of hotel, lighting can account for 7% of total energy consumption and up to 40% of total electricity consumption.<sup>35</sup>

Several types of energy efficiency lighting and affordable lighting technology exist, such as: compact fluorescent lamps (CFL), light-emitting diodes (LED), and fluorescent tube lighting (TL).

The lighting levels necessary for each building zone are established in part by the lighting regulations of the particular country, and these levels should be reached by using the most appropriate lamps for each application. For reference purposes, installed power is 10-20 W/m<sup>2</sup> for rooms and 15-30 W/m<sup>2</sup> for general service areas, giving an energy consumption of 25-55 kWh/m<sup>2</sup> per year.<sup>36</sup>

### **Lighting controls – occupancy-linked controls**

The principle of lighting control is to only light areas that are occupied or truly need light. This can only be achieved using technical measures, such as timers, occupancy sensors, automatic lighting control with key card, daylight sensors (photocell control), and connection to the building management system (BMS).

### **Regulation of space heating and cooling**

Space heating and cooling is generally the largest source of energy consumption in a hotel. To keep energy consumption reasonable, it is necessary to regulate temperatures according to the actual needs and occupancy of the different zones of the hotel. In particular, having close control for individual rooms is very important.

Temperature control systems can reduce energy consumption from heating and cooling by reducing the level of air conditioning in a room when it is not occupied, keeping the temperature at a standby level so that it can be quickly restored to the normal level when needed. Autonomous control systems can save energy up to 20-30%.

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<sup>35</sup> CHOSE Project, Energy Savings by Combined Heat Cooling and Power Plants (CHCP) in the Hotel Sector. <http://www.inescc.pt/urepe/chose/results.htm>

<sup>36</sup> *Ibid.*

## **Air conditioning and ventilation**

Two main categories of air-cooling systems exist:

1) Air conditioners (AC): these systems aim to provide an indoor environment that remains relatively constant despite changes in external weather conditions or in internal heat loads. Some systems are air-cooling systems only, while others can be used to provide heat, stabilise humidity, and ventilate in addition to space cooling.

2) Fans: Fans use 40 to 100 times less energy than a single room air conditioner. If an air conditioner is still required, the use of fans in conjunction with a higher thermostat setting can achieve energy savings.

For air conditioning and ventilation of hotel areas, there are usually various units available. As the occupation of the various hotel areas varies, so does the comfort level required in each zone, and the corresponding energy load (which is affected by decorative lighting, heat losses, solar gains, etc).

## **Cogeneration and trigeneration**

Co-generation (or Combined Heat and Power – CHP) is the term for simultaneous production of electricity and heat. Trigeneration (or Combined Heat, Cooling and Power – CHCP) refers to the simultaneous production of electricity, heat and cooling – the latter generated by residual heat using absorption chillers.

For the hotel sector, the use of microturbines is common. These generate both electricity and thermal energy from one single fuel (such as natural gas). Exhaust gases from combustion are used for space heating, domestic hot water, or heating swimming pools. The heat can also be used by absorption machines (trigeneration) to produce cold for refrigeration purposes. This means that, overall, the process is more efficient and requires less fuel.

## **Window and building insulation**

Insulation is the best and most direct way to reduce energy consumption related to heating or cooling in buildings. Heat and cool are lost due to transmission through external building elements such as walls, windows, floors, roofs, etc. The better a building is insulated, the less heat or cold is lost. Better insulation therefore means less energy needs to be consumed to maintain building temperature.

Good insulation means that heat and cold are kept inside the hotel for longer so that the heating or HVAC system does not need to work as hard. Because building insulation helps keep a building warm in winter and cool in summer, it reduces space heating and space cooling needs, and has the potential to reduce energy consumption for space heating up to 20-50% (with external wall and roof insulation). Thus improving the thermal insulation of hotel buildings is key to reducing the money

spent on heating and cooling.

**Potential savings through bioclimatic design**

Bioclimatic architecture refers to the design of buildings and spaces (interior – exterior – outdoor) based on local climate. It aims to provide thermal and visual comfort, making use of solar energy and other environmental sources. Basic elements of bioclimatic design are passive solar systems, which are incorporated onto buildings and utilise environmental sources (sun, wind, vegetation, water, or soil) for heating, cooling and lighting the buildings.

**Electric appliances with high energy-efficient rating**

It is recommended to replace or upgrade old appliances and electronic devices with new ones that have a high energy-efficiency rating.

The European energy labelling system (introduced by the Council Directive 92/75/EEC) rates products from A (the most efficient) to G (the least efficient). In an attempt to keep up with advances in energy efficiency, A+ and A++ grades were later introduced for refrigeration products.

Using equipment with a high energy-efficient rating (class A, A+ or A++) is particularly important for hotels considering that some appliances (such as kitchen, catering and laundry equipment) account for a considerable share of energy consumption in hotels. Catering may represent as much as 15% of energy consumptions, for example.

## 4.2 RENEWABLE ENERGY OPPORTUNITIES

The following table briefly describes renewable energy technologies that could be relevant for the hotel sector. More detailed information about these technologies is provided in the annex V.

**Solar thermal – solar hot water heating systems**

Solar water heating systems use free heat from the sun to warm domestic water. A conventional boiler or immersion heater is then used to make the water hotter, or to provide hot water when solar energy is unavailable.

There are many different types of solar hot water heating technologies available. The three main types of solar collectors are:

- Glazed flat plate collectors, generally used for domestic hot water;
- Unglazed plastic collectors, used mainly to heat swimming pools; and
- Evacuated tube collectors.

**PV electricity power system**

Solar photovoltaic (PV) systems convert solar radiation into direct-current electricity using semiconductors that provide the photovoltaic effect. PV electricity power systems produce electricity without noise or air pollution.



They are a viable option for upgrading energy performance in SME hotels.

Solar PV systems work almost anywhere in the world, but the amount of energy they produce depends on how much sunlight they receive. This is known as solar radiation.

Once installed, solar PV systems are generally very easy to maintain; they require very little maintenance and have practically no operating costs. Once installed, therefore, the electricity is essentially free.

### **Biomass boilers**

A biomass boiler is a sophisticated technology that can heat an entire building, performing the same job as a central heating boiler powered by natural gas, oil, or electricity.

A biomass boiler can provide both heating and hot water, and can even power modern under-floor central heating. It generates energy by burning wood pellets, wood chips, chopped logs, cereal plants, or a combination of all four. The boilers can be highly automated, although they require periodically emptying out the ash (typically every 2-8 weeks, depending on the appliance), which can then be recycled as compost.

### **Geothermal heat pump (ground source heat pump)<sup>37</sup>**

A geothermal heat pump (GHP) is a very efficient technology that uses the earth as a heat source (in winter) or a heat sink (in summer). The technology works as a central heating and/or cooling system that pumps heat to or from the ground.

A GHP takes advantage of the natural and nearly constant heat of the earth, which can be used as a heat resource in the winter and a heat sink in the summer.

GHPs are one of the most energy efficient and cost effective cooling and heating systems available, using much less energy than conventional heating/cooling systems and delivering 3 to 4 times the energy they consume.

GHP moves heat to or from the ground instead of generating it from heating coils or electrically operated compressors. GHP operating costs are significantly lower than conventional heating and cooling systems. GHP systems operate for 20 years or more with minimal maintenance.

Reversible heat pump systems: heat pumps systems are primarily used for space heating, but reversible ones can also be used to cool indoor spaces. Unlike air-conditioners, however, they can only reduce inside temperatures by a few degrees.

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<sup>37</sup> Switched on, Renewable Energy Opportunities in the Tourism Industry. United Nations Environment Programme Division of Technology, Industry and Economics

**Micro-hydropower energy systems**<sup>38</sup> The energy in falling water can be converted into electrical or mechanical energy by using it to power hydraulic turbines. The moving water turns a turbine, the turbine spins a generator, and clean electricity is produced.

Micro-hydropower systems are defined as power installations that typically produce up to 100 kW of electricity. A small or micro-hydroelectric power system can produce enough electricity for an SME hotel.

**Wind energy – small-scale wind turbines**<sup>39</sup> Wind turbine generators convert the kinetic energy in wind into mechanical power. This mechanical power can then be converted into electricity.

Wind turbines offer an attractive energy option for hotels situated in coastal areas, flat open plains and mountain passes exposed to consistent wind flows.

Once a wind turbine is properly installed, it requires little maintenance and does not emit greenhouse gasses or other airborne pollutants.

For most hotels, small- and medium-scale wind turbines are the most suitable. Although a large-scale turbine or wind farm is generally an inappropriate investment for hotel businesses, directly purchasing the electricity from a wind farm – or even owning part or all of a turbine – can be an economically attractive option for large hotels.

### 4.3 BEHAVIOURAL STRATEGIES AND CONSIDERATIONS

Behavioural change is the most cost-effective way to reduce energy consumption, and it is essential for implementing a successful energy efficiency or renewable energy project. Raising environmental awareness among staff and guests is key to achieving energy savings and carbon emissions reduction goals.

**Staff engagement** Involving staff in the hotel’s energy action plan is not only essential for the energy efficiency policy to be successful, it is also an effective way to inspire employees and give new meaning to the business! Indeed, when a hotel owner explains to staff members that energy efficiency is part of the hotel’s environmental strategy, the employees will often be happy to contribute to the hotel’s efforts to become a more sustainable business.

To actively involve hotel staff members, it is highly recommended that the hotel owner provide information and training on the actions that employees

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<sup>38</sup> Switched on, Renewable Energy Opportunities in the Tourism Industry. United Nations Environment Programme Division of Technology, Industry and Economics

<sup>39</sup> Key RE solutions for SME hotels, Micro hydropower energy system- n°1

should take to support these efforts. Because continuous improvement is an important part of the hotel action plan, the hotelier should also invite staff to regularly provide feedback and ideas about how to save more energy!

Staff information and training is a highly efficient and effective measure for improving the way energy is used in a hotel. Although it may require some time and money to inform and train the staff, the resulting benefits will become apparent in a very short time because staff behaviour has a direct impact on energy consumption (as does guests' behaviour).

Behavioural change does not imply reduction in comfort and does not mean setting restrictions. It is about improving the way energy is used, and avoiding unnecessary energy consumption.

One option is to design incentives that will motivate the staff to make efforts and be more careful about energy (and water) consumption.

### **Guests' engagement**

To be successful with an energy efficiency or environmental strategy, it is essential to involve the hotel guests. It is therefore strongly recommended to inform guests about the efforts to care for the environment and invite them to take simple actions to support these goals.

Most guests will be happy to know that the hotel is committed to reducing its negative environmental impacts, and will be keen to learn about the simple actions they can take to save energy and improve the environmental friendliness of their stay.

One recommendation is to use printed normative messages to influence behaviour among hotel guest. An example of this is to place printed messages containing procedural and normative information urging the guest to reuse their bath towels.<sup>40</sup> The message could be:

*"Many guests have expressed concerns about conserving energy. When given the opportunity \_a large majority\_ of guests in this room chose to reuse at least one of their towels each day. Because we value conservation and wish to support the habit of conserving, our hotel has initiated a conservation programme. Washing towels every day uses a lot of energy and water, so reusing towels is one way you can conserve. If you would like your towels replaced, please leave them on the bathroom floor. Towels left hanging on the towel rack tell us that you want to reuse them. Please reuse your towels."*<sup>41</sup>

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<sup>40</sup> Using normative social influence to promote conservation among hotel guests. P. Wesley Schultz, Azar M. Khazian and Adam C. Zaleski. CSU, San Marcos, Ca. US

<sup>41</sup> Using normative social influence to promote conservation among hotel guests. P. Wesley Schultz, Azar M. Khazian and Adam C. Zaleski. CSU, San Marcos, Ca. US

## 5 ECONOMICS AND FINANCIAL ANALYSIS



### HES E-TOOLKIT APPLICATION

#### + ROI Calculator

The HES e-toolkit provides a “Return on Investment Calculator” that assists the hotelier in making informed strategic decisions regarding EE & RET investments. The aim of the calculator is to support a cost-benefit analysis of the implementation of these technologies, and to estimate key metrics for each project.

The e-toolkit calculates the Internal Rate of Return (IRR), the Net Present Value (NPV), and the payback period. The ROI calculator requires that the user enter information that is relevant to the economics of the EE or RE project.

#### + Carbon footprint

The HES e-toolkit provides a tool to assist in calculating a hotel’s carbon footprint. The calculator allows the hotelier to assess its hotel’s emissions based on the electricity and fuel consumption information provided by the user, as well as the location and fuel type used.

### OBJECTIVE OF THE SECTION

The main goal of this section is to explain how to develop a return on investment analysis, define the metrics to evaluate an investment, explain the barriers and risk associated with investing in EE&RETs, and explain the different financing mechanisms available for EE and RE projects. The chapter describes the different incentives and eco-labels that exist to support EE&RETs.

Main concepts:

- Return on investment analysis
- Typical barriers and risk associated with investing in EE and RETs
- Some financing mechanisms for EE&RETs in the hotel sector
- Incentives for EE&RETs

## 5.1 RETURN ON INVESTMENT ANALYSIS

RE and EE investments deliver financial returns and energy savings over long periods into the future, so it is necessary to consider costs and benefits that occur at different times. It is therefore recommended to conduct a proper return on investment (ROI) analysis, develop a cash flow projection, and estimate the internal rate of return (IRR) and the Net Present Value (NPV) offered by these projects.

Each of the metrics used to develop a return on investment analysis will be explained in the following sections.

The HES e-toolkit provides a Return on Investment (ROI) calculator, which helps hoteliers and financial decision makers assess whether an investment in EE and/or RE could provide a reasonable return and payback period compared with other types of investments. The ROI calculator presents energy investment opportunities in terms of key financial metrics. More information and the ROI user manual can be found in Annex I.

### **Cash Flow Analysis**<sup>42</sup>

Cash flows are an essential part of most financial analyses and are needed to calculate the metrics described later in this section, which are also used in the e-toolkit ROI calculator.

Cash flow analysis lists the year-to-year costs and savings for all aspects of project implementation, and it is a method for analysing the financing, investing, and operating activities of a company. Cash flows from operating activities include all operating and maintenance expenses, interest paid, and income taxes paid, as well as all the energy savings (revenues) over the life of the equipment. Investment cash flow includes capital expenditures, and financing cash flow includes repayment of debt principal and dividends.

The primary goal of cash flow analysis is to identify cash flow problems and opportunities that can be expected from a potential project.

### **Net Present Value**<sup>43</sup>

The Net Present Value (NPV) is the total net cash flow that a project generates over its lifetime, including upfront costs, with discounting applied to cash flows that occur in the future. NPV indicates what a project's lifetime cash flow is worth today.

The NPV can be positive, negative or zero. A positive NPV means that the investment is more profitable than the 'do nothing' alternative. It is considered a "good" investment even when the NPV is relatively small (but greater than zero). This means that the cash received from energy savings or renewable energy income would be sufficient to repay the initial investment and receive a financial return on the initial investment equal or superior to the required rate of return (the discount rate).

Given more than one investment option, and all else being equal, the option with the largest (positive) NPV should be selected.

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<sup>42</sup> A Manual for the Economic Evaluation of Energy Efficiency and Renewable Energy Technologies. Walter Short, Daniel J. Packey, and Thomas Holt. NREL.

<sup>43</sup> Energy Star, Business Analysis report. [www.energystar.gov/ia/business/BUM\\_business\\_analysis.pdf](http://www.energystar.gov/ia/business/BUM_business_analysis.pdf)

### **Discount rate**<sup>44</sup>

Discount rate (or hurdle rate) is the rate used for computing present values, which reflects the fact that the value of money depends on the time in which the cash flow occurs. A euro received tomorrow is worth less than a euro received today because the opportunity to earn interest on the euro is lost. The discount rate is used to account for the risk inherent in an investment, and is not necessarily the same for all investors. The discount rate will be influenced by a wide variety of factors, such as the investor's rate of return, risk premium, planning horizon, interest rates, and so on. It can vary from country to country, and from company to company.

The discount rate is the criterion for determining if an investment passes the profitability test. If the IRR is higher than the depreciation rate, the investment is profitable. Discount rates are the marginal cost of capital, adjusted for a project's risk.

In EE and RE project analysis, the discount rate is very important. The discount rate is estimated in terms of perceived risk; the higher the risk, the higher the return and the discount rate expected, making more difficult to successfully compete against other possible business investments that could be seen less risky. EE and RE projects in hotels need to be evaluated on the same basis as other investment possibilities.

These investments may be seen as risky to hoteliers due to lack of information and resulting uncertainty. However, efficiency is in fact a low-risk investment that deserves a low discount rate. In finance theory, the time value of money is thought to increase with greater risk and uncertainty.

The following ideas can help the hotelier to choose an appropriate discount rate:

- Provide a percentage rate that captures the "opportunity costs", or the potential return on investment of alternative projects.
- Revenues from EE and RE investments can be anticipated, and consequently have a lower risk compared with other possible business investments (e.g. a new swimming pool or refurbishing the lobby)
- The discount rate could be the average value between the equity market risk premium and the interest rate that it is received from a risk-free savings account.
- Discount rates recommended for EE&REs, when further data are not available, are between 3% and 12%

### **Internal Rate of Return**<sup>45</sup>

Internal rate of return (IRR) is the interest rate that equates the present value of expected future cash flows to the initial cost of the project. Expressed as a percentage, IRR can be easily

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<sup>44</sup> Energy Star, Business Analysis report. [www.energystar.gov/ia/business/BUM\\_business\\_analysis.pdf](http://www.energystar.gov/ia/business/BUM_business_analysis.pdf)

<sup>45</sup> Ibid.

compared with loan or hurdle rates to determine an investment’s profitability.

The higher a project’s internal rate of return, the more desirable it is to undertake the project. An investment may be acceptable if the IRR exceeds the required “discount rate”, but it should be rejected otherwise.

### Payback period<sup>46</sup>

Simple payback is the amount of time, in years, necessary for future cash flows to return the original investment. Payback is an indicator of liquidity because it measures the speed with which an investment can be converted into cash. Payback is also used as an indicator of risk. As a general rule, short-term events can be predicted more precisely than events in the distant future; thus, assuming everything else is constant, projects with a shorter payback period are generally considered less risky.

### Financial Analysis Example

Hotel area: 37,000 m<sup>2</sup>  
 Annual utility bill: 720,000 EUR  
 Discount rate: 8%

Improvement	Cost	Savings	Payback
Lighting	350,000	116,667	3 years
Controls	200,000	80,000	2.5 years
Thermal Storage	150,000	37,500	4 years
Repairs	20,000	1,333	15 years
<b>Total Value</b>	<b>720,000</b>	<b>235,500</b>	<b>3.1 years</b>

### Cash flow

Years	yr. 0	yr. 1	yr. 2	yr. 3	yr. 4	yr. 5	yr. 6
Investment	720,000						
Savings		235,500	235,500	235,500	235,500	235,500	235,500
Costs		70,000	70,000	70,000	70,000	70,000	70,000
M&V		5,000	5,000	5,000	5,000	5,000	5,000
<b>Total</b>	<b>-720,000</b>	<b>160,500</b>	<b>160,500</b>	<b>160,500</b>	<b>160,500</b>	<b>160,500</b>	<b>160,500</b>
PV	-720,000	148,611	137,602	127,410	117,972	109,233	101,142

**NPV = EUR 21,972**

**IRR = 9%**

Additional information on metrics definitions, financing mechanisms, and incentives can be found in Annex VII.

## 5.2 TYPICAL BARRIERS AND RISKS ASSOCIATED WITH INVESTING IN EE AND RE

Although investments in EE and RE technologies are often cost effective and offer attractive

<sup>46</sup> Energy Star, Business Analysis report. [www.energystar.gov/ia/business/BUM\\_business\\_analysis.pdf](http://www.energystar.gov/ia/business/BUM_business_analysis.pdf)

returns on investment, many potential investment opportunities are overlooked or given very little consideration for a number of reasons. Broad national, economic and institutional factors restrict investment in EE and RE applications. The slow rate of progress in many countries towards investments in EE and RE projects is largely due to lack of financing, which is a key barrier to EE and RE investment. Project success requires not only the requisite economic conditions, but also technical, business and financial skills that help the hotelier sell the project to a bank or other source of capital.

Some of the barriers associated with investing in of EE and RE, and that difficult the access to financing include:<sup>47</sup>

<i>Lack of information</i>	EE and RE are unfamiliar to financiers due to lack of, or inadequate, information.
<i>Low demand</i>	Low demand at relatively high upfront cost for individual investor-clients. Smaller project sizes imply higher transaction costs.
<i>Perception of high risk</i>	EE and RE are sometimes considered unattractive due to high risk when adequate risk compensation in the form of risk coverage instruments or higher returns is not available.
<i>Lack of long-term financing</i>	A higher ratio of capital costs to operating costs creates the need for longer-term financing at reasonable rates.
<i>Technology competitiveness</i>	Current technologies are not yet fully competitive.
<i>Lack of experience from the market</i>	Less-experienced sponsors and project developers implies higher completion and operating risks.
<i>Utilities are reluctant</i>	Power grid operators can be reluctant to deal with decentralised energy supply.
<i>Inability to value public benefits</i>	Markets fail to value the public benefits of EE and RE.
<i>Cost of externalities not included</i>	The current price of fossil fuels does not include the cost of environmental externalities.
<i>Low price of conventional energy</i>	Low prices for energy from conventional sources make non-conventional sources less attractive.
<i>Fossil fuel subsidies</i>	Price distortions from existing subsidies and unequal tax burdens disadvantage renewable energy technologies in relation to other energy sources.

<sup>47</sup> Mainstreaming Environmental Finance into Financial Markets – Relevance, Potential and Obstacles. [www.icee.de/Mainstreaming%20Environmental%20Finance\\_Lindlein\\_iCee.pdf](http://www.icee.de/Mainstreaming%20Environmental%20Finance_Lindlein_iCee.pdf)



Normally, the main goal for commercial bankers and investors is financial return. Return is sexy, risk is not. And some EE and RE projects offer a low return combined with high perceived risk. This makes it complicated to find financing for these kinds of projects.

Some of the risks associated with EE and RE projects include:

<i>Project Sponsor Risk</i>	The project sponsor develops or sells energy services to the client or hotel. The sponsor is responsible for system design, construction, construction costs, and system performance over the contract period, as well as the risks associated with these responsibilities.
<i>Construction Risk</i>	Project sponsor and construction risks are linked. When construction begins, the risk increases sharply as funds are advanced to purchase materials and employ labour. This is when construction-financing expenses begin to accumulate. Construction costs could be greater than expected due to delays, lack of availability of equipment or other unforeseen events, which may increase the investment cost.
<i>Operational Risks</i>	The operational risks are risks or barriers that can have an effect on the complete plant operation – e.g. security of operation, availability of the equipment, expenditures for maintenance and repair, etc. Operational risks are those that occur after installation, testing and commissioning. They relate to breakeven analysis and the development of costs over the long term.
<i>Country and Sovereign Risk</i>	Country risk can include politically motivated interference with project conditions. For example, there may be circumstances where the host country cannot permit transfer of funds for debt service due to economic problems. Political and regulatory risks can affect all aspects of a project.
<i>Performance and Persistence Risk</i>	It is possible for disputes to arise regarding the actual energy savings achieved or energy produced, particularly in the event that changes are made in operations at the facility, or if there are changes in the energy rates. These changes can be devastating to the success of a project. This is why it is essential for the methodology to be agreed in contract documents for calculating, measuring, and verifying actual energy savings, as well as addressing methods to resolve disputes. Persistence of energy savings may be affected by equipment performance both in the present and the future.
<i>Contractual Liability</i>	It is important to ensure against contractual liability by including clear language in the agreement to address liability issues and methods for dispute resolution. Consider what would happen if a facility is closed down due to environmental hazard, flood, or war. What happens in the event a worker is harmed during construction? Some terms in the contract should articulate its enforceability and indicate clear contractual intentions in order to avoid widely differing interpretations.
<i>Risks Facing the Client</i>	The client faces risks in assessing the project sponsor or developer since the success of the project lies with them. It is essential that clients check the supplier's references. The client should have an internal technical employee work with the project developer as a way of mitigating risks associated with the sponsor or project developer in addition to ensuring that all assumptions are clearly articulated.

### 5.3 SOME FINANCING MECHANISMS FOR EE AND RE PROJECTS IN THE HOTEL SECTOR

Finance is essential for EE and RE projects, which cannot materialise without funding. Moreover, with inadequate financing structures and conditions, the disadvantage in competitiveness of EE and RE would increase, because the costs of electric power utilising RE technologies are highly sensitive to financing terms. It is important that the hotels understand where capital can be obtained for the up-front cost, and the different stages of development of an EE or RE project. There exist many financing sources for EE and RE projects.<sup>48</sup>

Equity	Equity can take the form of direct investment of the hotelier’s own capital, or of third party capital inputs, such as risk capital from venture capital funds or from wealthy families.
Loan	A loan may be obtained to finance the project. Before financing an EE or RE project, a bank may ask for a personal guarantee from the hotel owner. The lender’s goal is for the client to make minimum payments dependably, so lenders may require a down payment of up to 50% or more on loans for energy projects. Lenders consider EE and RE projects to be high risk, which results (sometimes) in less leverage, higher interest rates, and a shorter debt term.
Performance contracting and ESCOs	This option is attractive to the customer because it requires no up-front cost, since the efficiency project is paid for out of the future energy savings from the project itself. An Energy Service Company (ESCO) provides the initial financing and assumes the performance risks associated with the project. Until the project has been fully paid, the ESCO owns the upgraded equipment. During this period, the equipment capital and debt do not appear on the customer’s balance sheet
Savings guarantee	A savings guarantee can be entered into with the ESCO separately from an installation agreement. This is recommended if the contractual arrangement is not a performance contract. Performance contracts already include an implicit savings guarantee.
Operating lease <sup>49</sup>	Under an operating lease, the lessor owns the equipment and claims any tax benefits associated with its depreciation. At the end of the contract term, the customer can purchase the equipment at fair market value (or at a predetermined amount), renegotiate the lease, or have the equipment removed. An operating lease is also known as an “off-balance sheet” lease.

A more detail explanation of each type of financing is available in Annex VII.

<sup>48</sup> Energy Star, Business Analysis report. [www.energystar.gov/ia/business/BUM\\_business\\_analysis.pdf](http://www.energystar.gov/ia/business/BUM_business_analysis.pdf)

<sup>49</sup> FINANCIAL STRATEGIES, EPA 430-B-95-003 . [www.greenbiz.com/sites/default/files/document/O16F21669.pdf](http://www.greenbiz.com/sites/default/files/document/O16F21669.pdf)

## 5.4 INCENTIVES FOR EE/RETS

Many EE and RE projects and technologies are not cost effective without some form of incentives to level the playing field with conventional energy. It is important to explain to the hotelier that the incentives vary from country to country, and from technology to technology. The following sections will briefly explain some of these incentives.

### Important Note:

The REN21 Renewables Interactive Map is a research tool for tracking the development of renewable energy worldwide. The map offers a streamlined method for gathering and sharing information on incentives for EE&RETS. The interactive features of the map allow for browsing by country or world region and for searching by EE/RE technology or sector.

<http://www.map.ren21.net/>

### 5.4.1 Feed-in tariffs

The goals of mitigating climate change and reducing oil dependency are embraced across the EU. In January 2008, the European Commission proposed binding legislation to implement “20-20-20” targets, which set a binding target of supplying 20% of EU energy consumption from renewable sources, a reduction in EU greenhouse gas emissions of at least 20% below 1990 levels, and a 20% increase in energy efficiency, all by 2020. This ‘climate and energy package’ was agreed by the European Parliament and Council in December 2008 and became law in June 2009.<sup>50</sup>

Feed-in Tariffs (FITs) aim to support RE and EE market development and help achieve these ambitious targets. They are key instruments for encouraging the up-take of energy efficiency, renewable energy and particularly small-scale, low-carbon energy technologies, including:

- Wind
- Solar Photovoltaics (PV)
- Hydro
- Anaerobic digestion/biogas
- Biomass
- Cogeneration

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<sup>50</sup> European Commission, Climate Action. [http://ec.europa.eu/clima/policies/package/index\\_en.htm](http://ec.europa.eu/clima/policies/package/index_en.htm)

FITs put a legal obligation on utilities and energy companies to purchase electricity from renewable energy producers at a favourable price per unit, and this price is usually guaranteed over a certain time period. The most effective schemes are guaranteed for a period of around 20 years.

The Feed-In Tariff (FIT) has proven to be one of the most effective policy instruments in overcoming the cost barriers to introducing renewable energy and making it economically viable. The simple guarantees that FITs provide – including priority access to the grid, a set price per Kilowatt hour (kWh) that will cover the costs associated with electricity production, and a guaranteed term for which they will receive that rate – have turned several European countries into world leaders in the renewables sector. This is the case for Denmark in wind energy and for Germany in solar energy.<sup>51</sup>

Feed-in Tariffs have the potential to play a pivotal role in encouraging hotels to increase their renewable energy supply. This would have a considerable impact on overall emissions reduction, considering that the hotel industry is one of the most energy intensive service sectors. For example, if a hotel decides to cover its façade in photovoltaics, then the effects are two-fold: first, the hotel can increase its renewable energy supply while benefiting from the Feed-In Tariff and the marketing benefits of being able to visually convey its 'green' image to the public and to guests. Second, in order for the hotel to meet the more stringent energy and CO2 criteria, it will also need to reduce its energy demand. This might require, for example, installing a more efficient boiler, which can prove costly but for which there may be grants or loans available.

#### **Important Note:**

More information on Feed in tariffs for some countries can be found in Annex VIII.

### **5.4.2 Carbon finance**

Under the Kyoto Treaty, countries must meet their targets primarily through national measures. As described in Annex VIII, States can meet their GHG emissions targets through various flexible mechanisms allowing them to purchase reductions from financial exchanges. These mechanisms include:<sup>52</sup>

1. *Emissions Trading* – also known as the carbon market. Industrialised countries with obligations under the Kyoto Protocol may trade the quotas they have been allocated.

<sup>51</sup> Feed-In Tariffs Support renewable energy in Germany. [www.e-parl.net/eparlimages/general/.../080603%20FIT%20toolkit.pdf](http://www.e-parl.net/eparlimages/general/.../080603%20FIT%20toolkit.pdf)

<sup>52</sup> <http://biospherecapital.com/resources/frequently-asked-questions>

That is to say, if it is less expensive to reduce CO<sub>2</sub> emissions in Finland than in Denmark, then Denmark may allow Finland to reduce emissions on its behalf. In this way, Finland can store up CO<sub>2</sub> quotas, which Denmark may buy; and the emissions of CO<sub>2</sub> are reduced in the cheapest way possible.

2. *Joint Implementation (JI)* – This mechanism makes it possible for industrialised countries to supplement their CO<sub>2</sub> reductions at home with investments in projects in other industrialised countries (such as in Eastern Europe) that reduce greenhouse gas emissions or increase the rate of absorption of CO<sub>2</sub>. The CO<sub>2</sub> “gain” is converted into credits – or Emission Reduction Units (ERUs) – that can be deducted from the industrialised country’s national climate account.<sup>53</sup>
3. *Clean Development Mechanism (CDM)* – works in the same way as JI projects, with the difference that it concerns developing countries. Under the CDM, credits are named Certified Emissions Reductions (CERs).

For both JI and CDM projects, independent bodies must confirm that the projects do in fact lead to genuine emission reductions before they can be included in the CO<sub>2</sub> account. One CER or ERU is equivalent to one metric tonne of CO<sub>2</sub> and is tradable on carbon markets. There are several emissions trading schemes in existence with varying degrees of linkage, including the European Emissions Trading Scheme (ETS) and the Chicago Climate Exchange.<sup>54</sup>

### **European Union Emissions Trading Scheme (EU ETS)<sup>55</sup>**

The European Union Emissions Trading Scheme (EU ETS) is by far the largest emissions trading scheme in the world. It encompasses over 40% of Europe’s CO<sub>2</sub> emissions. Companies included in this scheme have the choice of reducing their own emissions, buying allowances in the market (called EU allowances, or EUAs), or purchasing credits through CDM or JI projects (with certain limitations on the volume of CDM and JI credits that can be purchased). The scheme has been running since 1<sup>st</sup> January 2005. Its second phase started on 1<sup>st</sup> January 2008 and ends on 31<sup>st</sup> December 2012, in line with the first Kyoto commitment period. A third phase is expected to run after this, but its form and duration have yet to be defined.

Emissions trading mechanisms can take two basic forms: cap-and-trade or project-based (sometimes also called baseline-and-credit):

#### a) *Cap-and-trade systems<sup>56</sup>*

Cap-and-trade systems are based on the allocation of a ceiling or cap on emissions over a period of time. The relevant authority allocates allowances either for free or by auction. Each allowance represents a pre-defined emissions amount (e.g. tonnes of CO<sub>2</sub> equivalent). In order to create a market, authorities allocate a limited number of allowances, below the current expected emissions level. This creates scarcity in the market, generating a positive value for the permits. Examples of this system include the

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<sup>53</sup> <http://biospherecapital.com/resources/frequently-asked-questions>

<sup>54</sup> An Analysis Of The Performance Of Certification Schemes In The Hotel Sector In Terms Of CO<sub>2</sub> Emissions Reduction

<sup>55</sup> An Analysis Of The Performance Of Certification Schemes In The Hotel Sector In Terms Of CO<sub>2</sub> Emissions Reduction

<sup>56</sup> [http://ec.europa.eu/clima/policies/ets/index\\_en.htm](http://ec.europa.eu/clima/policies/ets/index_en.htm)

US SOX allowances trading scheme, the Kyoto emissions trading scheme and the EU ETS.  
57

b) *Project-based or baseline-and-credit systems*

This system is based on projects that reduce emissions beyond a business-as usual scenario. In other words, they generate emissions reductions that are additional to what would have happened in the absence of the project. The business as usual scenario provides the baseline for these projects. Baselines are established from historical emissions data or through other methodologies (e.g. ratio of emissions to output). Projects that reduce emissions beyond the baseline earn emissions reduction credits, which can then be sold to parties that would use them for compliance or voluntary purposes. Typically, emissions reduction credits are not issued until the reductions have actually occurred. Examples of this system are CDM and JI projects, as explained above.<sup>58</sup>

**Is it possible for a hotel to benefit from a carbon finance scheme?**

EE and RE projects for hotels are normally too small to benefit from the traditional JI or CDM schemes because of the related transaction costs.

The modalities of “traditional” CDM have been set for big, individual, stand-alone emission-reduction projects that are implemented at a single point in time (e.g. a wind farm) and are able to absorb the CDM-related transaction costs, which are mostly fixed costs adding up to at least EUR 60,000 in upfront costs plus EUR 10,000 annual costs, or much higher in many cases. This also applies to JI due to its similar regulatory structure.

In December 2005, a “Programme of Activities” (PoAs) was introduced for CDM project activities, which opens the door to scaling up implementation of smaller RE and EE projects. The programmatic approach to carbon crediting is broad and can be used under the Clean Development Mechanism (CDM) and Joint Implementation (JI) of the Kyoto Protocol, and, in principle, also within programs based on Kyoto’s Assigned Amount Units (AAUs, or green investment schemes), or on European Allowances (EUAs)<sup>59</sup>.

A Programme of Activities (PoA), often called Programmatic CDM, collects and bundles several similar projects under one registration process, and is described as follows:

A programme of activities (PoA) is a voluntary coordinated action by a private or public entity which coordinates and implements any policy/measure or stated goal (e.g. incentive schemes and voluntary programmes), which leads to anthropogenic GHG emission reductions or net anthropogenic greenhouse gas removals by sinks that are additional to any that would occur in the absence of the PoA, via an unlimited number of CDM programme activities.<sup>60</sup>

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<sup>57</sup> [http://ec.europa.eu/clima/policies/ets/index\\_en.htm](http://ec.europa.eu/clima/policies/ets/index_en.htm)

<sup>58</sup> Ibid.

<sup>59</sup> PoA BLUEPRINT BOOK- Guidebook for PoA coordinators under CDM/JI. KfW, BMU, Perspectives Climate change.

<sup>60</sup> Scaling Up Demand-Side Energy Efficiency Improvements through Programmatic CDM, ESMAP Technical Paper 120/07 December 2007

In other words, a PoA is:

- A voluntary action;
- Implementing a policy, measure or stated goal;
- Coordinated by a public or private entity; and
- Resulting in emission reductions or removals that are additional.

### 5.4.3 Carbon offsetting<sup>61</sup>

Carbon offsetting is intended to mitigate CO<sub>2</sub> emissions. It involves quantifying the emissions resulting from an activity and then purchasing ‘credits’ from emission reduction projects that prevent or remove an equivalent amount of carbon dioxide elsewhere. The concept of paying for emissions reductions to be made somewhere else is similar to that of emissions trading as previously described. Whilst emissions’ trading is regulated by a strict formal and legal framework, carbon offsets generally refer to voluntary actions by individuals or companies that are arranged by commercial or not-for-profit carbon-offset providers. The quantity and varying quality of available schemes has proved controversial, but there are some formal standards for voluntary carbon offsets, such as the “Gold Standard” ([www.cdmgoldstandard.org/](http://www.cdmgoldstandard.org/)). However, with so many schemes and very little in the way of verification, it is difficult to establish which schemes are truly authentic.

Carbon offsetting has become popular in recent years, particularly with consumers in western countries who are concerned about reducing the negative effects of their energy intensive lifestyles and economies on the environment and who wish to reduce their carbon footprint. Various sectors within the travel and tourism industry have been enthusiastic in embracing the concept, and an increasing number of hotels around the world now claim to be ‘carbon neutral’ by having offset their emissions.<sup>62</sup>

The “carbon footprint” of a hotel is the total set of greenhouse gas (GHG) emissions caused by the hotel through its daily operation and activities.

### 5.4.4 Eco-labels and certifications<sup>63</sup>

There is a remarkable proliferation of awards, prizes, tools, eco-labels and certification initiatives for environmentally sustainable performance in hotels. Despite the growth in numbers of programmes for environmental quality, most are not well known, either by consumers or tourism businesses. For those who are aware of them, competition and overlap among local, national and international eco-labels that cover the same product group and have similar criteria can cause confusion. Currently, over 100 eco-labels and certification schemes are available for tourism, ecotourism and the hospitality industry worldwide. Europe alone has over 60 labelling schemes

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<sup>61</sup> Voluntary Carbon Offsets. July 2007. [www.parliament.uk/documents/post/postpn290.pdf](http://www.parliament.uk/documents/post/postpn290.pdf)

<sup>62</sup> Scaling Up Demand-Side Energy Efficiency Improvements through Programmatic CDM , ESMAP Technical Paper 120/07 December 2007

<sup>63</sup> Eco-labels for Tourism in Europe: Moving the Market towards more Sustainable Practices by Herbert Hamele. [www.gtz.de/de/dokumente/en-tourism-materials2004-labels.pdf](http://www.gtz.de/de/dokumente/en-tourism-materials2004-labels.pdf)

Certification is the process of assessing compliance with pre-established criteria and has been heralded as an important step towards the ‘greening’ of hotels. Certification schemes are created by privately operated companies and NGOs and are based on voluntary initiatives by the hotels themselves. The schemes provide the participating hotel with a certificate stating that it has satisfied a number of environmental criteria, and the schemes normally also then allow the hotels to display a logo or marketing brand to help communicate to the consumer that the choice of accommodation implements good environmental practices. Some of the leading eco-labels and certification include:

**Table 3. Eco-labels and certifications**

VISIT	Voluntary Initiative for Sustainability in Tourism	<a href="http://www.visit21.net/">http://www.visit21.net/</a>	Promotes and supports sustainable tourism development through the representation, promotion and mutual co-operation of international, national and regional certification schemes and other voluntary initiatives for sustainable tourism at an international level.
Green Hospitality Award	Funded by the Environmental Protection Agency, Ireland.	<a href="http://www.ghaward.ie/">http://www.ghaward.ie/</a>	The Green Hospitality Awards are recognised both nationally and internationally as standards that allow members to achieve good environmental performance.
EC3 Green Globe	EC3 Global	<a href="http://www.ec3global.com/">http://www.ec3global.com/</a>	An international environmental management and certification company.
Nordic Swan	The Nordic Ecolabel	<a href="http://www.nordic-ecolabel.org/">http://www.nordic-ecolabel.org/</a>	A voluntary eco-labelling scheme that evaluates a product's impact on the environment throughout the whole lifecycle.
EU Flower	The European Ecolabel	<a href="http://ec.europa.eu/environment/ecolabel/">http://ec.europa.eu/environment/ecolabel/</a>	A voluntary scheme, established in 1992, to encourage businesses to market products and services that are kinder to the environment. Products and services awarded the Ecolabel carry a flower logo.
LEED-EB	LEED for Existing Buildings Rating System	<a href="http://www.usgbc.org/DisplayPage.aspx?CMSPageID=221">http://www.usgbc.org/DisplayPage.aspx?CMSPageID=221</a>	Helps building owners and operators measure operations, improvements and maintenance on a consistent scale, with the goal of maximising operational efficiency while minimising environmental impacts.
EMAS	Eco-Management and Audit Scheme	<a href="http://www.iema.net/emas">www.iema.net/emas</a>	A voluntary initiative designed to improve companies' environmental performance. It was initially established by European Regulation 1836/93, which has since been updated twice with Regulation (EC) No. 1221/2009, coming into force in January 2010.

More information on eco-labels and certification schemes is available in Annex VIII.



## 6 DEVELOPING EE/RET PROJECTS IN HOTELS



### HES E-TOOLKIT APPLICATION

#### + Developing a project

The e-toolkit accompanies and supports the following steps needed to implement an EE/RET project:

- Assessment
- Action
- Development
- Monitoring

A more detailed document “hotel energy management guidelines” is available for download at <http://hes.e-benchmarking.org/learn-more.html>

#### + Marketing hotel activities

The HES e-toolkit provides additional information on how to market the hotel’s activities.

The e-toolkit provides useful information and recommendations related to energy audits for hotels. This information is included in the fact sheet that can be downloaded from the HES e-toolkit website using the reference, “Key EE solutions for SME hotels – n°II. Energy audit of the hotel”.

### OBJECTIVES OF THIS SECTION

The goals of this section are to describe the steps that are entailed in developing an EE and RE project in a hotel. It provides recommendations for marketing the energy improvement efforts.

Main concepts:

- Steps to developing an EE and RE project in a hotel
- Some recommendations for marketing the hotel’s efforts

## 6.1 STEPS TO DEVELOPING EE AND RE PROJECTS IN HOTELS

Implementing an EE or RE technologies in a hotel may be challenging due to the sheer number of factors that must be considered. The e-toolkit is structured to support hoteliers in this process.

### Step 1: Assess

It is important for the hotelier to implement an assessment of the current energy performance of the hotel in order to have a baseline scenario against which to evaluate possible future improvements. It can also be important to help the hotelier assess whether his or her hotel facilities are in line with environmental and energy regulations.

A preliminary energy audit (or walk-through energy audit) is the simplest and quickest form of audit. It includes a brief analysis, and a walk-through of the hotel's facilities. Normally, only major energy problems will be identified, and energy improvement measures are briefly described and estimated. Some rough estimates of the required investment and expected payback period are provided. This energy audit is not sufficient to make a final investment decision, but it is useful for determining whether there is a need to develop a more detailed audit.<sup>64</sup>

Hoteliers can use the e-toolkit to assess a hotel's energy performance and carbon footprint. It provides a useful 'Energy solutions' report that helps the hotelier identify the technologies that would work best for his or her hotel. It also includes some case studies that may also be applicable. These case studies illustrate the benefits of implementing energy efficiency and renewable energy measures in typical hotels in Europe.

### Step 2: Action

Once the baseline scenario has been defined, the hotelier can then develop an action plan to address the hotel's requirements, or to upgrade its energy performance and achieve the associated economic and environmental benefits.

It is highly recommended to seek advice from a technology specialist (e.g. from local energy agencies, technology suppliers or project developers) to carry out a preliminary (walk-through) audit.

It is recommended that the hotelier:

- Seek advice regarding relevant considerations and the implications of installing more efficient and renewable energy solutions.
- Get quotes on the costs, financing options and incentives associated with the possible improvements.

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<sup>64</sup> Gard Analytics, Energy, Economics and environmental research. <http://www.gard.com/auditType.htm>

This information can be entered in the e-toolkit ROI calculator to support the hotelier in evaluating investment decisions. It helps the hotelier compare the benefits of different technologies and potential solutions for the hotel.

It is important for the hotelier to undertake a more detailed energy audit before making an investment decision. A more complete audit will require analysing utility bills from the preceding 12 to 36 months, detailed analysis of the hotel's energy profile (i.e. daily and annual energy consumption), and a detailed financial analysis for each possible measure, taking into account implementation costs, operating and maintenance costs, and the procedures and requirements for benefiting from relevant incentives.

### **Step 3: Develop the strategy (implementation)**

The third step is focused on the implementation of the action plan. Once the hotelier has decided on the energy solutions that will be implemented in the hotel and has commissioned their installation, it is important for the hotelier to ensure that all activities proceed in accordance with the budget, time schedule, quality requirements, and relevant laws and regulations.

### **Step 4: Monitor**

Once the energy improvements have been implemented, it is important to monitor the energy performance of the building, and ensure the correct operation of the EE/RE measures. It is recommended that the hotels establish monitoring and maintenance procedures to ensure appropriate operation of the energy measures.

The e-toolkit can help hoteliers to monitor the energy performance and assess the improvements by entering energy consumption data from different time periods.

#### Some recommendations:

A checklist for energy saving measures in hotels is included in Annex X of this manual.

It is useful to work with an ESCO, as was explained in chapter 6. This requires entering into an Energy Service Agreement (ESA). There are several critical elements to these kinds of agreements. The primary elements that should be included or considered for inclusion in an ESA are briefly described in the Annex XI. In general, the contract will be defined by the financing arrangement that has been chosen by the hotel owner; and there are numerous contractual terms that should be included in any ESA.

## 6.2 MARKETING HOTEL ACTIVITIES

It can be difficult for guests to recognise and understand a hotel's achievements related to saving energy, improving energy systems, and environmental efforts more broadly. The certifications, awards and eco-labels for hotels can be complicated to understand and, partly due to their proliferation and the current need for more standardised regulation, can sometime be ignored by consumers. For this reason, it is important to have a communication strategy to inform customers about the energy and environmental measures undertaken by the hotel.

Here are some recommendations:

1. Communicate why the hotel is implementing energy-saving measures and renewable energy technologies.
2. If the hotel encourages guests to take energy-saving measures themselves (i.e. reuse towels), explain why.
3. Explain to clients the importance of conserving natural resources and how the hotel supports this.
4. Provide training for hotel reception staff on how to communicate with guests about the hotel's efforts.
5. If the hotel has improved its energy efficiency or has implemented solar panels or more efficient lighting, inform guests about this. It could be included in the hotel's literature, or communicated through notices in the rooms mentioning the energy improvements, their climate change implications and how they benefit the guests.

Marketing the hotel's energy improvements can help the hotel gain additional exposure in the media. Many media outlets like to know about innovative companies and increasingly look for stories related to the environment. Enhancing environmental performance and implementing EE and RE are ways of distinguishing a hotel. Forward-thinking hotel managers can use this distinction as a competitive advantage to increase revenues. It enables them to generate positive publicity that engages both new and existing target customers.

However, it is important to recommend to hotels not to start a vigorous "environmental" marketing campaign until it has made concrete progress and can demonstrate results. Otherwise, there is the risk of losing credibility with guests who are savvy enough to identify empty marketing campaigns when they see them.

### **Important Note:**

The HES e-toolkit includes a section with recommendations for the hotelier regarding how to market the activities. This section is included in the window that is shown after filling out a project questionnaire, on the left-side menu.

## 7 CASE STUDIES



### **HES e-toolkit application**

The HES e-toolkit provides a compilation of case studies on the successful implementation of EE and RE technologies in hotels, which can be consulted in the HES e-toolkit website.

To access the case studies, the user must choose the “Application Components” option on the main menu, and select “Learn more...”. An option entitled “Case Studies and Best Practices” will then be displayed that can be downloaded.

### **OBJECTIVE OF THE SECTION**

The main goal of this section is to show the experiences of a variety of hotels that have implemented EE&REs. It explains the different measures implemented by these hotels, along with the associated savings, investment, financing, and payback periods.

Main concepts:

- Specific EE and RE technologies implemented in some hotels
- Estimated savings resulting from these measures
- Associated investments and payback periods
- Sources of financing

### CASE 1: Complex Saint Nikola<sup>65</sup>

Address: 8800 Sliven, 1 Sofiysko Shose Blvd. ,  
tel.: +359 44 676676, e-mail: svetinikola.sl@gmail.com

Complex Saint Nikola is located at the entrance of the town of Sliven, close to the main road Sofia-Bourgas. At guest disposal are parking slot, conference halls, lobby bar and restaurant. All year round the hotel offers comfortable accommodation services in 4 apartments, 20 double and 8 single rooms, all equipped with air conditioning, satellite TV, mini bar and Internet connection.

The hotel has been recently renovated by the owner Fishcom PLC. The total project cost was 419 853 EUR, which 190 336 EUR was provided by the Bulgarian Energy Efficiency Fund.

#### Implemented energy saving measures:

- a. Thermal insulation of external walls;
- b. Replacement of window frames with PVC ones with double glass packets;
- c. Thermal insulation of roof slate;
- d. Thermal insulation of walls and floor slate;
- e. Installation of solar panels for domestic hot water;
- f. New boiler on natural gas.

**Estimated savings:** electricity: 49 221 kWh/y, thermal energy: 578 308 kWh/y, greenhouse gases emission reduction: 335 tCO<sub>2</sub>/y  
Cost savings – 95 421 EUR/y (as a result of fuel switch and estimated savings)

The average payback period of the implemented measures is 4.4 years.



<sup>65</sup> case study provided by UNEP from <http://www.svetinikola-sl.com/> ; <http://www.bgeef.com/>

## Case 2: SPA Hotel Bankya Palace<sup>66</sup>

Address: 70, Varna Blvd. 1320, Bankya

E-mail: [hotel@bankyapalace.bg](mailto:hotel@bankyapalace.bg)

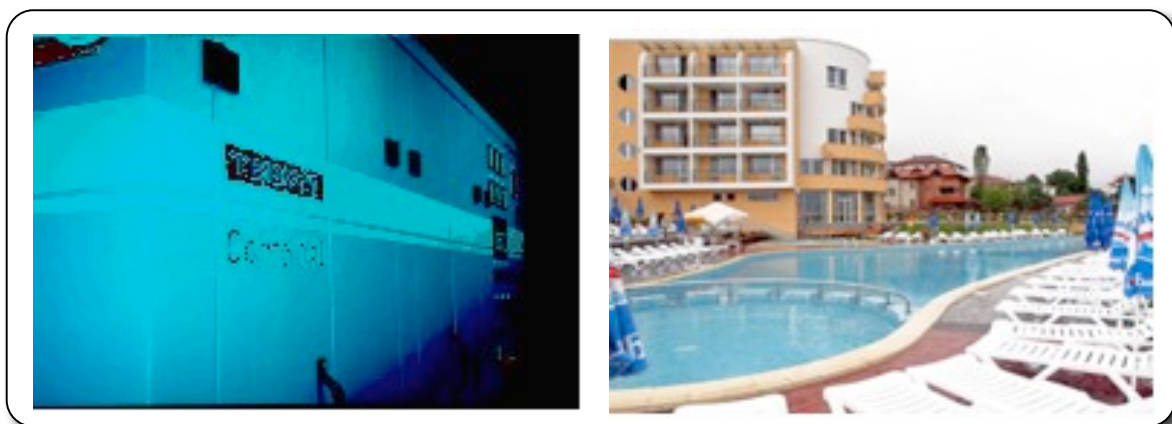
Tel.: +359 2 812 20 20

SPA Hotel Bankya Palace is situated in the folds of Lyulin Mountain with a splendid view of Vitosha Mountain in the town of Bankya at a distance of 20 km from the capital city Sofia. SPA hotel Bankya Palace offers to its guests: 39 double rooms; 19 single rooms; 2 rooms for disabled people; 13 suites; a presidential suite. All the rooms are equipped with air-conditioning, TV, mini-bar, direct telephone line and internet access. The main hall of the restaurant has 120 seats; At guests disposal are also: VIP lounge with 30 seats; lobby bar; garden BBQ; swimming-pool bar, conference centre with four halls and technical equipment, business centre, a luxury SPA centre; open air swimming-pool, children's swimming-pool and Jacuzzi, fitness centre, bowling hall, billiard, guarded parking.

A small CHP unit on natural gas was installed in the summer of 2003 in Hotel Bankya Palace. The unit has 150 kW electrical capacity and 226 kW thermal capacity. The aim of hotel management is to improve the energy situation of the hotel and therefore to reduce energy bills providing in the meantime higher quality service - room comfort and all-year-round usable swimming pool.

The CHP unit Cento 140 has a gas combustion engine manufactured by TEDOM company, and is supplied and installed by Chime Ltd., Bulgaria. This is a turnkey project - the supplier undertakes feasibility analysis, design, installation, commissioning, tuning/adjustments and maintenance of the CHP unit. The installation reaches 6000 h/y at full capacity and covers the basic heat load for DHW and swimming pool operation. During the heating season additional gas fired boiler is used to cover the high heating loads. The system has an overall efficiency of 87 % and consumption of natural gas of 45,5 Nm<sup>3</sup>/hour at 100 % capacity utilization and 31,5 Nm<sup>3</sup>/hour at 50 % capacity utilization.

The overall project cost was about 145 000 Euro. The applied financing scheme was a 10 year leasing agreement with the equipment supplier company Chaim Ltd. At this conditions and prices of the natural gas in the time of construction, the payback period was 3.5 – 4 years. The annual cost saving are estimated to be about 365 000 EUR



<sup>66</sup> case study provided by UNEP from <http://www.bankyapalace.com/>; [www.managenergy.net](http://www.managenergy.net) <http://www.opet.dk/default.asp>

### Case 3: Hotel Chateau Montagne<sup>67</sup>

**Address:** 5600 Troyan, 34, Stara planina str.

Tel. +359 670 68900

E-mail: [chateau@hotel-cm.com](mailto:chateau@hotel-cm.com)

Chateau Montagne Hotel is a new hotel, opened in the beginning of 2007. It is located in the central part of the Troyan town. The hotel is a three-star category family hotel and has a total number of 60 beds. It has a restaurant, lobby bar, fitness centre, sauna and massage hall. Chateau Montagne offers room service, tourist information and free parking for its customers. The hotel is also suitable for business tourism with its convenient conference hall.

The hotel was assessed under the cleaner production (CP) methodology as a part of the Programme for Sustainable Development of Enterprises in Bulgaria. The following energy efficiency options have been identified in 2008:

**Table 4. EE options for the Hotel Chateau Montagne**

CP options	Environmental Benefits	Economic Savings
System for change of sheets and towels in the rooms upon visitors request and put signs for visitors for the availability of such an option.	25 % reduction of changing of sheets and towels - Reduction of water, detergents and energy for washing the towels and sheet.	Investment - Printing materials (paper, toner, etc) = 80 BGN/year 30 working hours per year Savings: 518 EUR/year (1013 BGN)
Switch off the mini bars, when the rooms are not in use.	Reduction of consummation of electricity by 29946 kWh per year	Investment - 40 working hours per year Savings: 759 EUR/year (1484 BGN)

The hotel management implemented the proposed options for direct implementation in 2009. At the same time the management started a monitoring program, which will provide regularly data for energy monitoring and evaluation of the proposed measures. What is more important is that the process of option generation, evaluation and continuous improvement of the processes is accepted and in practice at the hotel. The benchmarking indicator total energy consumption, kWh/Guest night has been reduced from 44,55 kWh/guest night in 2008 to 22,29 in 2009 while the EU reference value for the category is 34,2 kWh/guest night. For 2009 the savings achieved are more than 7690 EUR, also by introducing energy efficient lighting.



<sup>67</sup> case study provided by UNEP from <http://www.hotel-cm.com/> ; <http://www.serc.bg>



#### Case 4: Central Hotel Forum<sup>68</sup>

Address: 41 Tsar Boris III Blvd. Sofia 1612, Bulgaria

Tel.: +359 2 954 44 44

e-mail: [central@central-hotel.com](mailto:central@central-hotel.com)

Central Hotel Forum is located in the wide centre of Sofia, 4 minutes by car from most of the important administrative buildings, banks, trade centres, museums, cultural and architectural monuments. The hotel is of 4-star category and was opened in April 2003 after renovation of a former hotel. All the luxury type rooms and apartments are with king-size beds and the standard rooms have queen-size beds. All of them can be divided in separate beds. Most of the rooms have terraces. There is a non-smoking floor. Central Hotel Forum boasts 3 restaurants - Sofia, Forum and Central. The walls between them can be removed, which results in one big restaurant seating up to 200 guests.

The hotel was assessed under the cleaner production (CP) methodology as a part of the Programme for Sustainable Development of Enterprises in Bulgaria. One of major energy efficiency option identified was the improvement of the lighting system:

**Table 5. EE Options in Central Hotel Forum**

CP options	Environmental Benefits	Economic Savings
Change room / public areas / conference halls lights with energy-saving bulbs	Energy savings; Reduced CO <sub>2</sub> emissions.	Investment – 4100 EUR; Savings – 2100 EUR per year; Payback period - 2 years

Due to the relatively high investment cost in a period of economic crisis the hotel decided to implement the proposed option step by step. In 2010 all halogen 30 W bulbs in the corridors and lobby have been replaced with LED bulbs, which consume only 5 W. As these premises are illuminated 24 hours per day all year round, the estimated energy savings are 11 000 kWh/y.



<sup>68</sup> case study provided by UNEP from <http://www.central-hotel.com/forum/en/index.html> ; <http://www.serc.bg>

### CASE 5: Duni Holiday Village<sup>69</sup>

Address: 8130 Sozopol, Bulgaria

Tel.: +359 55022260

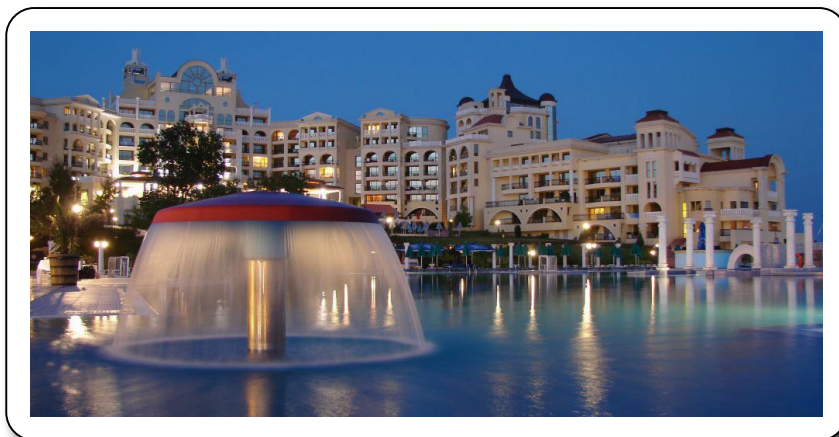
e-mail: [krasimiraivanova@duni.bg](mailto:krasimiraivanova@duni.bg)

Duni Holiday Village is a high-class recreational holiday resort situated in Sozopol Municipality on the Southern Black Sea coast. The facility is located on a total land area of 740,000 m<sup>2</sup> around a fine bay and next to a natural preserved area. The total capacity is 1,230 rooms all operating on the all-inclusive principle. The complex offers a great number of recreational facilities like 4 main restaurants, 2 specialized a-la-carte restaurants, one pub, one Italian restaurant, 4 lobby bars, 4 pool bars, one snack bar on the beach, 4 swimming pools, wide and fine-sanded beach strip and shallow sea water, mini clubs for kids and youngsters, 10 tennis courts and sports facilities, SPA and related services, 2 conference rooms seating 250 and 180 respectively, Internet centre, etc. The rooms are equipped with central air conditioning, cable TV, internal and external phone, mini-bar, safe, a balcony overlooking the sea or the park, bathroom with a shower and a bathtub and hair dryer.

The resort was assessed under the cleaner production (CP) methodology as a part of the Programme for Sustainable Development of Enterprises in Bulgaria. A very effective measure, which was applied in one of the hotels Marina Royal Palace is a system for heat recovery of the waste heat from the air conditioning system for DHW heating. During the sunny days the utilization of waste heat covers up to 90% from the needs of diesel for hot water. It was decided to install new chillers on the roof of hotel Pelican having the same heat recovery system and the estimated savings are summarized in the table below:

**Table 6. Options in Duni Holiday Village**

CP options	Environmental Benefits	Economic Savings
Replacement of chillers of hotel Pelican with new ones with heat recovery	Saving of 9000 litres of diesel fuel and 15 000 kWh electricity per year	Investment – 46 000 EUR; Savings – 10 200 EUR per year; Payback period – 4,5 years



<sup>69</sup> case study provided by UNEP from <http://www.dunibg.com/> ; <http://www.serc.bg>

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## 9 USEFUL LINKS

Organization	Description	Link
European Environment Agency	Information on climate change, water, land use.	<a href="http://www.eea.eu.int/">http://www.eea.eu.int/</a>
International Energy Agency	Information on policies, energy, and trends.	<a href="http://www.iea.org/">http://www.iea.org/</a>
REN21, the Renewable Energy Policy Network for the 21st Century	Information on the status of RE worldwide covering markets, investment, policies, industry and rural (off-grid) RE in developing countries.	<a href="http://www.ren21.net">www.ren21.net</a>
Carbon Trust Practical Guides	From biomass heating to swimming pool energy efficiency, the Carbon Trust has a downloadable practical guide to help develop a project. Typically they include an introduction and overview of the technologies, a technical manual and an implementation guide from initial assessment to operation and maintenance. Although targeted at a UK audience, the information contained in the guides will be useful worldwide.	<a href="http://www.carbontrust.co.uk/Publications">www.carbontrust.co.uk/Publications</a>
Small Wind Handbook, NREL	The Small Wind Handbook provides comprehensive explanations for the things to consider when installing a small scale wind turbine. It includes discussion of the different types of small wind turbines available, how to calculate energy output, economic assessment and environmental considerations. It is designed for a US audience; however the majority of the information provided is applicable anywhere in the world.	<a href="http://www.windpoweringamerica.gov/">http://www.windpoweringamerica.gov/</a>
Light bulb Cost Analysis Calculator, AJ Design	This webpage provides a useful tool to calculate the cost savings associated with using different lighting technologies.	<a href="http://www.ajdesigner.com/">http://www.ajdesigner.com/</a>
Energy Cost Calculators for Energy-Efficient Products US DoE	This website provides a series of Excel based spreadsheets to calculate and compare the energy and cost of different energy-efficient appliances including lighting, dishwashers, heating and cooling equipment, showerheads, food service equipment, office equipment and more.	<a href="http://www1.eere.energy.gov">www1.eere.energy.gov</a>
Energy Efficiency Best Practice Guides, Australia – Victoria.	This website provides a series of step-by-step guides to improving the energy efficiency of different commercial systems including pumping, heating, air quality, hot water and more. Although written for an Australian business audience they are useful worldwide.	<a href="http://www.resourcesmart.vic.gov.au/">http://www.resourcesmart.vic.gov.au/</a>

Efficient Pool and spa. US DoE	This web resource provides information regarding different ways of increasing the energy efficiency of swimming pool heating. It includes an overview of different technology approaches and guides to sizing, efficiency and cost comparisons of different systems.	<a href="http://www.energysavers.gov/">http://www.energysavers.gov/</a>
Geothermal Hot Water. McQuay International	This manual goes through all of the factors that need to be considered when designing a ground source heat pump system. It includes a background to the technical theory and design properties of key components. Written for a US audience, it is nonetheless useful worldwide.	<a href="http://www.mcquay.com/">www.mcquay.com/</a>
Hydro Resource Evaluation Tool. Lancaster University	The Hydro Resource Evaluation Tool is an extremely useful tool for identifying what information is needed to calculate the economic, energy, environmental and technical potential of a micro-hydro system. Designed for a UK audience, most of the information is nonetheless applicable worldwide.	<a href="http://www.engineering.lancs.ac.uk/">http://www.engineering.lancs.ac.uk/</a>
Biomass Energy Centre UK Forestry Commission	This website provides an overview of the different bioenergy technologies and fuels. It identifies issues that must be considered in each stage of the development process and of the fuel chain. Designed for a UK audience, the regulations and some of the agricultural practices may not be applicable in many countries; however it still provides a wealth of useful technical information.	<a href="http://www.biomassenergycentre.org.uk/">http://www.biomassenergycentre.org.uk/</a>
CHP, PV, Wind, Energy, storage. The California Energy Commission	This website provides a series of resources on different distributed energy resources including CHP technologies, PV, wind and energy storage. This site is particularly useful for technology assessment and economic analysis. It is designed for a Californian audience, thus the permitting and regulatory information is California and US specific.	<a href="http://www.energy.ca.gov">http://www.energy.ca.gov</a>

## 10 GLOSSARY

Important definitions in alphabetical order

Alternating Current (AC):	An electric current that reverses its direction at regularly recurring intervals, usually 50 or 60 times per second.
Capacity Factor:	The ratio of the electrical energy produced by a generating unit for the period of time considered to the electrical energy that could have been produced at continuous full-power operation during the same period.
Cogeneration:	A plant designed to produce both heat and electricity from a single heat source.
Combined Cycle:	An electric generating technology in which electricity is produced from otherwise lost waste heat exiting from one or more gas (combustion) turbines. The exiting heat is routed to a conventional boiler or to a heat recovery steam generator for utilization by a steam turbine in the production of electricity. Such designs increase the efficiency of the electric generating unit.
Combined Heat and Power (CHP) Plant:	See Cogeneration
DC- Direct current	Is the continuous flow of electricity through a conductor such as a wire from high to low potential. In direct current, the electric charges flow always in the same direction, which distinguishes it from alternating current (AC). DC is commonly found in many low-voltage applications, especially where these are powered by batteries, which can only produce DC. Most automotive applications use DC although the generator is an AC device, which uses a rectifier to produce DC. Most electronic circuits require a DC power supply. There is currently (2000) some interest in High Voltage Direct Current (HVDC) transmission systems. DC is also used in solar power systems that are supplied by solar cells.
Emissions:	Anthropogenic releases of gases to the atmosphere. In the context of global climate change, they consist of radiatively important greenhouse gases (e.g., the release of carbon dioxide during fuel combustion).
Flat Plate Panel	A medium-temperature solar thermal collector that typically consists of a metal frame, glazing, absorbers (usually metal), and

insulation and that uses a pump liquid as the heat-transfer medium: predominant use is in water heating applications.

Generation (Electricity):	The process of producing electric energy from other forms of energy; also, the amount of electric energy produced, expressed in Kilowatt-hours (KWh).
Geothermal Energy:	As used at electric power plants, hot water or steam extracted from geothermal reservoirs in the Earth's crust that is supplied to steam turbines at electric power plants that drive generators to produce electricity.
Grid:	The layout of an electrical distribution system.
Heat Pump:	A year-round heating and air-conditioning system employing a refrigeration cycle. In a refrigeration cycle, a refrigerant is compressed (as a liquid) and expanded (as a vapour) to absorb and reject heat. The heat pump transfers heat to a space to be heated during the winter period and by reversing the operation extracts (absorbs) heat from the same space to be cooled during the summer period. The refrigerant within the heat pump in the heating mode absorbs the heat to be supplied to the space to be heated from an outside medium (air, ground or ground water) and in the cooling mode absorbs heat from the space to be cooled to be rejected to the outside medium.
High-Temperature Collector:	A solar thermal collector designed to operate at a temperature of 80°C or higher.
Incentives:	Subsidies and other Government actions where the Government's financial assistance is indirect.
Operation and Maintenance (O&M) Cost:	Operating expenses are associated with operating a facility (e.g., supervising and engineering expenses). Maintenance expenses are that portion of expenses consisting of labour, materials, and other direct and indirect expenses incurred for preserving the operating efficiency or physical condition of utility plants that are used for power production, transmission, and distribution of energy.
Passive Solar:	A system in which solar energy alone is used for the transfer of thermal energy. Pumps, blowers, or other heat transfer devices that use energy other than solar are not used.
Peak Watt:	A manufacturer's unit indicating the amount of power a photovoltaic cell or module will produce at standard test conditions (normally 1,000 watts per square meter and 25°C).



- Photovoltaic (PV) Cell:** An electronic device consisting of layers of semiconductor materials fabricated to form a junction (adjacent layers of materials with different electronic characteristics) and electrical contacts and being capable of converting incident light directly into electricity (direct current).
- Photovoltaic (PV) Module:** An integrated assembly of interconnected photovoltaic cells designed to deliver a selected level of working voltage and current at its output terminals, packaged for protection against environment degradation, and suited for incorporation in photovoltaic power systems.
- Subsidy:** Financial assistance granted by the Government to firms and individuals.

## 11 UNITS AND CONVERSION FACTORS



### HES e-toolkit application

The HES e-toolkit is able to take data entries from different energy units, and makes the necessary conversions between units automatically. The energy units will be used in the initial questionnaire section, and when using the ROI calculator

Energy is measured in different units.

Joule (J)	This is the basic energy unit of the metric system
Calorie (cal)	Historically the calorie was defined in terms of the heating of water. Thus, in a traditional definition, one calorie is the amount of heat required to raise the temperature of 1 gram of water by 1°C
British thermal unit (Btu):	This is the English system analogue of the calorie.
Kilowatt-hour (kWh):	The kilowatt-hour is a standard unit of electricity production and consumption.
Barrels of oil Equivalent (boe)	It is a unit of energy based on the approximate energy released by burning one barrel of oil (158.99 litres)

The HES e-toolkit use different energy units according to the energy type.

### For electricity

Kilowatt-hour (kWh):	The kilowatt-hour is a standard unit of electricity production and consumption. A kWh is equivalent to 1,000 Wh
Megawatt-hour (MWh)	A Megawatt hour is equivalent to 1,000 KW

### For Coal and District Heating<sup>70</sup>

Metric tonne (Mton)	Wight of the coal used, equivalent to 1,000 Kg
Short tonne	Equivalent to 907.18 kg, normally used in the US
TeraJoule (TJ)	It is equivalent to 1 trillion Joules , equal to 163 Barrels of oil equivalent (boe)
GigaJoule (GJ)	It is equivalent to 1 billion Joules, equal to 0.163 Barrels of oil Equivalent (boe)
MegaJoule (MJ)	It is equivalent to 1 million Joules
Million BTU (mmBTU)	Is equivalent to 1'000,000 Btu, equal to 0.17 Barrels of oil Equivalent (boe)
Therm (thm)	It is equivalent to 100000 British thermal units

### Liquefied petroleum gas and Natural gas.

The LPG and natural gas use some of the units mentioned before or some times: m3, litres, gallon

### Heavy Oil, light oil or residential fuel oil

Normally measured in weight - Kg or tonnes - or volume – litres, gallon-.

### Biomass wood chips, pellets & wood logs/Wood briquettes

Normally measured in weight – Kg, tonnes, Pound (lb)

### Some conversion factors<sup>71</sup>

1 Btu =	251.9958 cal.
1 kWh =	1000 watts:
1 kWh =	$3.6 \times 10^6$ J
1 kWh =	3,412 Btu.
1 kWh =	860 Kcal
1Kcal =	1000 cal

<sup>70</sup> <http://www.santos.com/conversion-calculator.aspx>

<sup>71</sup> <http://www.santos.com/conversion-calculator.aspx>

Contact  
**World Tourism Organization**  
ICR-HES@unwto.org

42, Capitan Haya  
28020 Madrid SPAIN  
Tel: +34 91 5679 305  
[www.unwto.org](http://www.unwto.org)

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