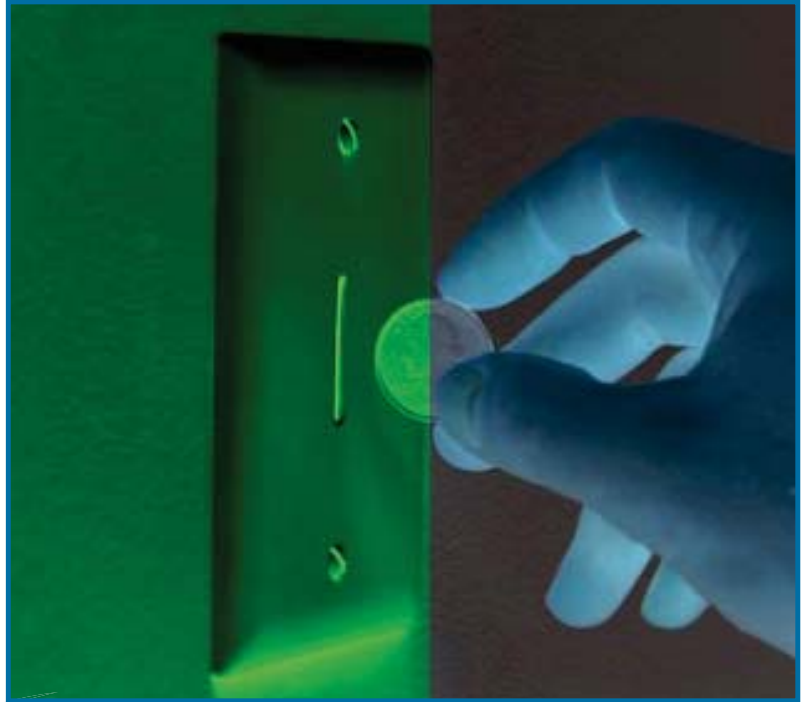




# ENERGY EFFICIENCY SERIES



HOTEL  
ENERGY  
SOLUTIONS



## Key Energy Efficiency Solutions for SME Hotels

Hotel Energy Solutions Official Partners



Supported by





**KEY ENERGY EFFICIENCY SOLUTIONS  
FOR SME HOTELS**



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## Project Supported by





## KEY ENERGY EFFICIENCY SOLUTIONS FOR SME HOTELS

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# An urgent need to save energy in the hotel industry

## Tourism and the environment

The hotel industry represents one of the most important sectors of the travel and tourism industry and is the world's largest single employer.

Compared to most other categories of commercial buildings, lodging facilities are unique as regards to operational plans, the types of amenities and services offered, as well as the resulting patterns of natural resource use. Many of the services provided by hotels are resource-intensive, resulting in a significant ecological footprint. Indeed, tourism is one of the three main sectors impacting the environment, after industry and agriculture.

Hotels interact with the environment at every stage of their life cycle. A typical life cycle analysis tends to show that the siting of the hotel and the construction phase represent less than 10 % of the total amount of energy consumption over a 50 year period, thus demonstrating the importance of the environmental impact during the hotel's operational phase (Despretz, 2001). Therefore, the main environmental impact is most significant during the operational phase of the hotel, which is why efforts have to be made to reduce those environmental impacts.

The following figure illustrates the main environmental elements involved in running a hotel. The "input" describes the material needed for the operation of a hotel; the "output" is the emission or by-product caused by the operation of the hotel.

Hotels have a direct influence on the input and output.



Figure 1. Environmental aspects involved in running a hotel.

## An urgent need to reduce energy consumption

Among the activities that have a major impact on the environment, hotel energy consumption is fundamental. Hotel facilities rank among the top five in terms of energy consumption in the tertiary building sector (only less than food services and sales, health care and certain types of offices) (US EIA, 1998). Although no collective data is available on global energy consumption in the hotel sector, Gössling (2002) estimates that 97.5 TWh of energy was used in hotel facilities worldwide in 2001. Furthermore, European hotels generate nearly half.

The world total of hotel rooms (Eurostat, 2006) was estimated to use a total of 39 TWh (terawatt hours) in 2000 (CHOSE, 2001).

Considering almost 80% of the energy in the world is derived from fossil sources (IEA, 2005), the sector's contribution to global environmental problems, including global warming and climate change, is not negligible. It is estimated that a typical hotel annually releases between 160 and 200 kg of CO<sub>2</sub> per m<sup>2</sup> of room floor area, depending on the fuel used to generate electricity, heating or cooling (EEO, 1994). Global hotel-based CO<sub>2</sub> emissions were assumed to be at the level of 55.7 Mt in 2001 (Gössling, 2002), while Bohdanowicz (2005-a)??? estimates that European hotels emit more than 10 Mt of carbon dioxide annually – given the estimated energy consumption of 39 TWh annually. These figures indicate an urgent need for reducing energy consumption in the hotel industry.

## Promoting energy efficiency solutions in the sector, particularly to SME hotels

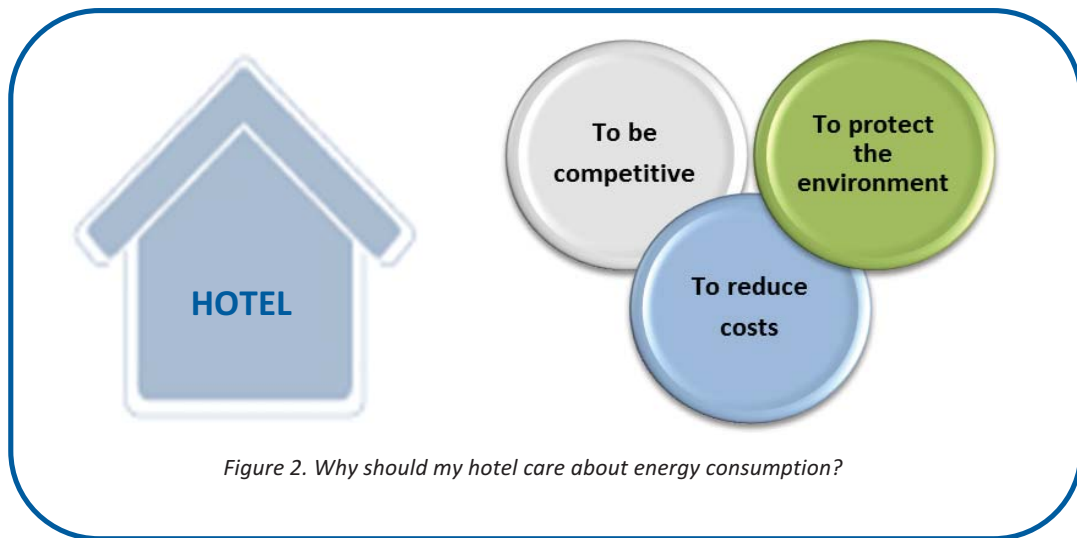
One way to foster energy efficiency and the reasonable use of energy in the hotel sector in Europe is to promote the most adaptable, practical and cost-effective solutions to SME hotels in order to improve their energy efficiency and use of renewable energy solutions.

SME hotels are an important market to target. Although no specific data has been reported by small businesses, it is assumed that SME hotels account for a large part of energy consumption by the hotel sector, for at least two reasons: the hotel accommodation sector in Europe is dominated by small businesses, which provide around 90% of the total number of rooms, while only 10% are owned by leading European hotel operators; studies show that small independent hotels are less proactive about the environment than large hotel chains, as the majority of the energy efficiency improvements have been implemented by large hotel chains.

Factors such as the challenge to be more competitive, the importance of reducing costs and the growing sensitivity to protecting the environment, all combine to create conditions favourable to the implementation of energy efficiency solutions and the introduction of renewable energy options.



- ***Why should my hotel care about energy consumption?***



- ***As a small hotel, what can I do to reduce my energy consumption?***

- Make a first assessment
- Involve your guests
- Improve equipment efficiency
- Protect the building from temperature extremes
- Involve your staff

# Energy Efficiency Solutions suitable for use in SME hotels

The aim of this chapter is to provide a review of energy efficiency solutions that are available to SME hotels. It is not intended to be a guide for hotel managers, but rather an overview of 20 solutions which can be selected individually for implementation in a SME hotels.

## Classification of energy efficiency solutions into appropriate “solution groups”

The energy efficiency solutions available to SME hotels have been classified into three different groups (see the review of solutions provided below):

- the “energy management” solution group compiles the solutions which deal with the hotel’s energy policy as well as staff and guest involvement with the energy conservation measures;
- the “reduction of heating and cooling needs of the hotel” solution group contains technical solutions for the renovation of the building’s exterior, in order to reduce the hotel’s heating and cooling needs;
- the “equipment efficiency” solution group compiles technical solutions with the aim of improving the hotel’s equipment efficiency, either by a better operational system (through equipment control and regulation) or by replacing equipment.

More details on the classification used for the solutions review are provided in the table below. The link with the solution “domain” (Make a first assessment / Involve your staff / Involve your guests / Protect the building from cold and hot weather / Improve equipment efficiency) – which is more intuitive and more easily understood by a hotel manager – is also illustrated.



<b>Energy management</b>
▶ Assess the energy profile of your hotel
▶ Draw up a simple energy policy
▶ Adopt good housekeeping practices
▶ Ensure regular servicing and maintenance of your equipment
▶ Improve energy management by providing information to staff and guests
<b>Reduction of the hotel's heating and cooling needs</b>
▶ Improve the thermal insulation of the building
▶ Prevent uncontrolled air infiltration
▶ Improve microclimate & protect the building from the summer heat
<b>Equipment efficiency</b>
▶ Better operational use of current equipment (through equipment control and regulation)
▶ Improve heating efficiency (space heating and hot water production)
▶ Improve space cooling efficiency
▶ Improve ventilation efficiency
▶ Improve lighting efficiency
▶ Improve (other) electric equipment efficiency

- Involve your guests**
- Involve your staff**
- Make a first assessment**
  
- Protect the buildings from temperature**
  
- Improve equipment efficiency**

Table 1: Classification used to present energy efficiency

## General information for each energy efficiency solution

For each energy efficiency solution, we have tried to provide the information in the following format:

- **area of the hotel concerned** : this indicates whether the solution is for a specific area of the hotel (guest rooms, kitchen...) or if it concerns the building as a whole (in this case, the term “general” is used),
- **basic requirements / conditions** : this provides straightforward information on the conditions which must be found in the hotel in order for the solution to be applicable,
- **the energy consumption activities (or end-usage) concerned** : this indicates which consumption activities are affected by the solution (space heating, space cooling, hot water, lighting, etc.);
- **potential energy savings**: when the information is available, an estimate is provided of the energy savings which can be obtained by implementing this specific activity (%age),
- **ease of implementation** : this scale indicates the level of difficulty for implementing the solution : from easy (\*) to moderate (\*\*) and difficult (\*\*\*),
- **ideal time to implement the solution** : if applicable, an indication is provided on the best time to implement the solution,
- **return on investment** : this is the ratio of cost versus benefit, expressed in terms of number of years; note that :
  1. the numbers given are only indicative as the costs of the solutions may vary, as well as the costs of energy (depending on local conditions...). Therefore energy savings and return on investment. are expressed in terms of years (ex: < 5 years) rather than as an exact number of years;
  2. the information is provided only to give a idea of whether the energy efficiency solution has a quick return on investment (< 5 years) or a slower return on investment (10-20 years). It is interesting to note that some energy efficiency solutions do not require financial investment (e.g.: good housekeeping practices and other energy management solutions) and therefore have a return on investment of less than one year;
  3. information on the return on investment may not be provided, either because the information is not available or because it is not relevant (e.g. when the cost of labour is a large factor, making it difficult to provide an estimate on a European-wide scale; or when the benefits in terms of energy reduction depend greatly on a hotel’s unique situation – for example the benefits that a hotel can obtain from maintenance and regulation of HVAC equipment depends largely on the current equipment and on the maintenance history);

**Link with other energy efficiency solutions**

This indicate other possible solutions the implementation of which should considered at the same time.



# Review of energy efficiency solutions suitable for use in the hotel sector (table format)



Energy management										
Solution category	#	Hotel area	Energy Efficiency Solution	Basic requirements / conditions	End-usage	Potential energy savings	Ease of implementation	Ideal time to implement the solution	Return on investment	Link with other solutions
► Assess the energy profile of your hotel.	1	GENERAL	<ul style="list-style-type: none"> <li>Monitor your energy consumption by keeping track of your energy bills. Prepare a table showing the total annual consumption and cost of each type of energy (electricity, gas, etc), for each year you have the information. Calculate the energy performance index, which is the total energy use normalised over the floor area, and the energy use per guest night sold. Compare performance year-by-year, research changes in consumption. Compare this usage with industry benchmarks. Set objective targets.</li> </ul>	<ul style="list-style-type: none"> <li>There is no energy monitoring in the hotel.</li> </ul>	<ul style="list-style-type: none"> <li>All</li> </ul>	Immediate corrective actions resulting from energy monitoring can lead to an energy saving of 8 to 10%.	*	Before defining and implementing an action plan.	<1 year	To be considered together with #2.
	2	GENERAL	<ul style="list-style-type: none"> <li>When budget permits, install <u>electricity sub-meters</u> for monitoring the energy used by major building systems or by hotel zone (office, guest rooms, etc.).</li> </ul>	---	<ul style="list-style-type: none"> <li>Usage of electricity (all)</li> </ul>		**		<1 year	To be considered together with #1.
	3	GENERAL	<ul style="list-style-type: none"> <li>Conduct a <u>simple energy audit</u> of the hotel.</li> </ul>	<ul style="list-style-type: none"> <li>No energy audit has been carried out for the last 5 years.</li> </ul>	<ul style="list-style-type: none"> <li>All</li> </ul>	Depends on the resulting action plan.	*	Before defining and implementing an action plan.	<1 year	Alternative to #4.
	4	GENERAL	<ul style="list-style-type: none"> <li>Have an <u>energy audit</u> made by an energy expert. This will usually reveal problems that can be solved through simple and inexpensive actions, identify areas with saving opportunities and help set priorities.</li> </ul>	<ul style="list-style-type: none"> <li>No energy audit has been conducted for the past 5 years.</li> </ul>	<ul style="list-style-type: none"> <li>All</li> </ul>	Depends on the resulting action plan.	*	Before defining and implementing an action plan.	<i>depends on the actions taken after the audit</i>	Preparatory to #6 (action plan).
	5	GENERAL	<ul style="list-style-type: none"> <li>Have a <u>carbon emission assessment</u> of your hotel made to evaluate the GHG emissions resulting from each activity (laundry, space conditioning, supplies transportation, etc.).</li> </ul>	---	<ul style="list-style-type: none"> <li>All</li> </ul>	Depends on the resulting action plan.		Before defining and implementing an action plan.	<i>depends on the actions taken</i>	Complementary to #4 (energy audit).

<i>Solution category</i>	<i>#</i>	<i>Hotel area</i>	<i>Energy Efficiency Solution</i>	<i>Basic requirements / conditions</i>	<i>End-usage</i>	<i>Potential energy saving</i>	<i>Easiness of implementation</i>	<i>Best moment to implement the solution</i>	<i>Pay back period</i>	<i>Link with other solutions</i>
<b>► Draw up a simple energy policy</b>	6	GENERAL	<p>Set up an <u>action plan</u>:</p> <ul style="list-style-type: none"> <li>• Draw up an <u>energy policy</u> establishing objectives and the means by which the hotel intends to meet them.</li> <li>• Make someone <u>responsible</u> for energy usage in your hotel. Ensure « energy » is a regular agenda item in your routine operational meetings.</li> <li>• Provide a <u>small energy saving investment budget</u> to fund low cost energy saving measures.</li> </ul>	<ul style="list-style-type: none"> <li>• There is no explicit action plan to reduce energy consumption of the hotel.</li> </ul>	<ul style="list-style-type: none"> <li>• All</li> </ul>	Depends on the action plan.	*	Before undertaking any renovation work.	<1 year	To be considered together with #1, #2, #3, #4 and #5.
<b>► Adopt good housekeeping practices</b>	7	GUEST ROOMS	<ul style="list-style-type: none"> <li>• Ensure that <u>temperature for room thermostats</u> are set at the correct level for guest comfort, to reduce the need to open doors and windows while air conditioning or heating is on.</li> </ul>	<ul style="list-style-type: none"> <li>• Guest rooms are equipped with individual thermostat controls.</li> </ul>	<ul style="list-style-type: none"> <li>• Space heating</li> <li>• Space cooling</li> </ul>		*	Immediately.	<1 year	To be considered along with #39, #40 and #43.
	8	GUEST ROOMS	<ul style="list-style-type: none"> <li>• <u>Power and lighting switched off</u>: ensure that all power and lighting is switched off in unoccupied room as soon as guests have checked out.</li> </ul>	<ul style="list-style-type: none"> <li>• Guest rooms do not have automatic access control system.</li> </ul>	<ul style="list-style-type: none"> <li>• Lighting,</li> <li>• Space heating,</li> <li>• Space cooling.</li> </ul>		*	Immediately.	<1 year	To be considered together with #44 and #45.
	9	GUEST ROOMS	<ul style="list-style-type: none"> <li>• In summer or winter conditions, ensure that <u>curtains, blinds and windows</u> are closed when a room is unoccupied (unless opened for special reasons).</li> </ul>	---	<ul style="list-style-type: none"> <li>• Space heating,</li> <li>• Space cooling.</li> </ul>		*	Immediately.	<1 year	To be considered together with #40.
	10	KITCHEN	<ul style="list-style-type: none"> <li>• Do not <u>switch on</u> kitchen appliances until required, and switch them off when they are no longer in use.</li> <li>• Ensure <u>dishwashers</u> are only run when full – running a partly loaded machine uses as much energy a fully loaded one.</li> <li>• Try and ensure <u>refrigerators</u> and freezers are located away from high temperature cooking areas; a cooler, well-ventilated place will reduce electricity consumption.</li> <li>• Defrost fridges, mini-bars and freezers when necessary.</li> <li>• Ensure cellar cooling equipment</li> </ul>	<ul style="list-style-type: none"> <li>• The hotel has a kitchen.</li> </ul>	<ul style="list-style-type: none"> <li>• Catering.</li> </ul>		*	Immediately.	<1 year	

		operates at minimum energy input: <ul style="list-style-type: none"> <li>- check temperatures are not set too low,</li> <li>- keep cellar doors closed,</li> <li>- ensure no heat producing equipment – such as ice maker, freezer, in-line beer cooler – is located in the cooled cellar.</li> </ul>							
11	LAUNDRY	<ul style="list-style-type: none"> <li>• Operate washing machines and dryers with <u>full loads</u> to minimise number of operations.</li> <li>• Ensure that <u>water temperature</u> and amount of water used are in accordance with the washing machine manufacturer’s instructions.</li> </ul>	<ul style="list-style-type: none"> <li>• The hotel has a laundry facility.</li> </ul>	<ul style="list-style-type: none"> <li>• Laundry</li> </ul>		*	Immediately.	<1 year	
12	FRONT OFFICE	<ul style="list-style-type: none"> <li>• Ensure that the main entrance <u>door is closed</u>, to avoid air infiltration.</li> </ul>	<ul style="list-style-type: none"> <li>• The hotel has no automated doors.</li> </ul>	<ul style="list-style-type: none"> <li>• Space heating,</li> <li>• Space cooli.</li> </ul>		*	Immediately.	<1 year	
13	GENERAL	<ul style="list-style-type: none"> <li>• <u>Lighting switch off</u>: switching lights off when ambient light levels are sufficient or rooms are unoccupied can reduce lighting energy consumption significantly.</li> </ul>	---	<ul style="list-style-type: none"> <li>• Lighting</li> </ul>		*	Immediately.	<1 year	To be considered together with #44 and #45.
14	FLOOR SERVICES	<ul style="list-style-type: none"> <li>• <u>Adjust thermostats</u> to suitable temperatures, especially in unoccupied rooms (meeting rooms, offices, restaurant...).</li> </ul>	---	<ul style="list-style-type: none"> <li>• Space heating</li> </ul>		*	Immediately.	<1 year	To be considered together with #43.
15	GENERAL	<ul style="list-style-type: none"> <li>• <u>Air conditioning adjustment</u>: <ul style="list-style-type: none"> <li>- turn off air conditioning systems in rooms such as the banquet hall, function rooms, restaurants, etc., as soon as the areas are closed.</li> <li>- adjust thermostats to appropriate temperature and do not set them too low (in summer conditions, room temperature between 22-24°C is acceptable to most people).</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• The hotel has an air conditioning system.</li> </ul>	<ul style="list-style-type: none"> <li>• Space cooling</li> </ul>		*	Immediately.	<1 year	To be considered together with #43.
16	GENERAL	<ul style="list-style-type: none"> <li>• <u>Free cooling</u>: <ul style="list-style-type: none"> <li>- In summer conditions, disconnect the air conditioning system when the outside temperature is lower than the inside temperature to benefit from a free space cooling system through ventilation.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• The hotel is equipped with a ventilation system that is connected to an 'all-air' air conditioning system.</li> </ul>	<ul style="list-style-type: none"> <li>• Space cooling</li> </ul>		*	Immediately.	<1 year	



	17	GENERAL	<ul style="list-style-type: none"> <li>• <u>Electrical system</u>: Turn off electrical equipment when not in use, or not required for any prolonged period. Be aware in particular of the stand-by on hi-fis, televisions, computers, etc.</li> </ul>	---	<ul style="list-style-type: none"> <li>• Usage of electricity (all)</li> </ul>		*	Immediately.	<1 year	To be considered together with #42.
	18	SWIMMING POOL	<ul style="list-style-type: none"> <li>• Ensure a <u>pool cover</u> is used to reduce evaporation in summer and heat loss in winter.</li> </ul>	<ul style="list-style-type: none"> <li>• The hotel has a heated swimming pool.</li> </ul>	<ul style="list-style-type: none"> <li>• Swimming pool water heating</li> </ul>	up to 95% on water heating.	*	Immediately.	<1 year	
<b>Solution category</b>	<b>#</b>	<b>Hotel area</b>	<b>Energy Efficiency Solution</b>	<b>Basic requirements / conditions</b>	<b>End-usage</b>	<b>Potential energy saving</b>	<b>Easiness of implementation</b>	<b>Best moment to implement the solution</b>	<b>Pay back period</b>	<b>Link with other solutions</b>
► <b>Ensure regular servicing and maintenance of your equipment</b>	19	GENERAL	<ul style="list-style-type: none"> <li>• Have an easy-to-follow regularly updated <u>manual</u> detailing the operating methods, instructions and standard control settings for HVAC services equipment.</li> </ul>	---	<ul style="list-style-type: none"> <li>• Space heating</li> <li>• Space cooling.</li> </ul>		*/**	Immediately.	<1 year	To be considered together with #20 and #21.
	20	GENERAL	<ul style="list-style-type: none"> <li>• Ensure regular servicing and maintenance of <u>heating equipment</u>. E.g.: - Ensure the mixing control valves of the heating/ cooling system are properly activated.</li> </ul>	---	<ul style="list-style-type: none"> <li>• Space heating</li> </ul>		*/**	Immediately.	<2-3 years	To be considered together with #19 and #21.
	21	GENERAL	<ul style="list-style-type: none"> <li>• Ensure regular servicing and maintenance of <u>ventilation and cooling equipment</u>. E.g.: - Regularly clean air filters located in guest rooms, public areas and back of the house. - Check the settings of air conditioning plants. - Clean fan coil units, air handling units and cooling coils in order to improve cooling efficiency and indoor air quality. - Clean air ducts to remove dust and dirt accumulated inside so as to improve system efficiency and indoor air quality. - Check cooled air ducting for air tightness, to avoid air leakage and energy wastage.</li> </ul>	<ul style="list-style-type: none"> <li>• The hotel has a ventilation and/or air-conditioning system.</li> </ul>	<ul style="list-style-type: none"> <li>• Space cooling / ventilation</li> </ul>		*/**	Immediately.	<2-3 years	To be considered together with #19 and #20.

	22	GENERAL	<ul style="list-style-type: none"> <li>Ensure regular servicing of <u>steam pipes</u>. <ul style="list-style-type: none"> <li>E.g.: Ensure steam pipes of steam ovens, dryers, washing machines, etc. are properly insulated to maintain the efficiency of equipment.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>The hotel has steam piping.</li> </ul>	<ul style="list-style-type: none"> <li>Specific usage of electricity</li> </ul>		*/**	Immediately.	<2-3 years	
	23	KITCHEN	<ul style="list-style-type: none"> <li>Ensure the correct maintenance and adjustment of <u>cooking appliances</u>. <ul style="list-style-type: none"> <li>E.g.: ensure that a correct ratio of gas and air is maintained in the gas kitchen stove (in accordance with the specification).</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>The hotel has a kitchen.</li> </ul>	<ul style="list-style-type: none"> <li>Specific usage of electricity</li> </ul>		*/**	Immediately.	<1 year	
	24	KITCHEN	<ul style="list-style-type: none"> <li>Regularly <u>clean cooking appliances</u>: burners, ignition, pilot light...</li> </ul>	<ul style="list-style-type: none"> <li>The hotel has a kitchen.</li> </ul>	<ul style="list-style-type: none"> <li>Specific usage of electricity</li> </ul>		*	Immediately.	<1 year	
	25	LAUNDRY	<ul style="list-style-type: none"> <li>Ensure the correct maintenance and adjustment of <u>laundry machines</u>.</li> </ul>	<ul style="list-style-type: none"> <li>The hotel has a laundry.</li> </ul>	<ul style="list-style-type: none"> <li>Specific usage of electricity</li> </ul>		*/**	Immediately.	<1 year	
	26	LAUNDRY	<ul style="list-style-type: none"> <li>Check and regularly <u>clean the dryers' filters</u>.</li> </ul>	<ul style="list-style-type: none"> <li>The hotel has a laundry.</li> </ul>	<ul style="list-style-type: none"> <li>Specific usage of electricity</li> </ul>		*	Immediately.	<1 year	
	27	SWIMMING POOL	<ul style="list-style-type: none"> <li>Ensure sand inside the <u>backwash chamber</u> is replaced annually to maintain water filtration efficiency.</li> </ul>	<ul style="list-style-type: none"> <li>The hotel has a swimming pool.</li> </ul>	<ul style="list-style-type: none"> <li>Specific usage of electricity</li> </ul>		*	Immediately.	<1 year	
<b>Solution category</b>	<b>#</b>	<b>Hotel area</b>	<b>Energy Efficiency Solution</b>	<b>Basic requirements / conditions</b>	<b>End-usage</b>	<b>Potential energy saving</b>	<b>Easiness of implementation</b>	<b>Best moment to implement the solution</b>	<b>Pay back period</b>	<b>Link with other solutions</b>
► <b>Improve energy management by providing information to staff and guests</b>	28	GENERAL	<ul style="list-style-type: none"> <li><u>Inform and train staff</u> on: <ul style="list-style-type: none"> <li>importance of energy efficiency,</li> <li>good housekeeping practices,</li> <li>preventive maintenance of equipment.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>There is no staff training or information on energy issues.</li> </ul>	<ul style="list-style-type: none"> <li>All</li> </ul>		*	Immediately.	<1 year	
	29	GENERAL	<ul style="list-style-type: none"> <li><u>Communicate to guests</u>: <ul style="list-style-type: none"> <li>communicate on good practices for space heating, opening windows, switching off lights ...</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>The guests are not informed on best practices for energy saving.</li> </ul>	<ul style="list-style-type: none"> <li>All</li> </ul>		*	Immediately.	<1 year	

Reduction of heating and cooling needs of the hotel

Solution category	#	Hotel area	Energy Efficiency Solution	Basic requirements / conditions	End-usage	Potential energy saving	Easiness of implementation	Best moment to implement the solution	Pay back period	Link with other solutions
► Improve the thermal insulation of the building	30	GENERAL	<ul style="list-style-type: none"> <li><u>Windows insulation</u>: where windows are to be replaced, double glazed units with high insulation properties should be used, as the additional cost is marginal. The benefits derived include reduced heat losses, reduced condensation, improved thermal comfort and noise reduction.</li> </ul>	<ul style="list-style-type: none"> <li>The hotel has simple glazing windows.</li> </ul>	<ul style="list-style-type: none"> <li>Space heating</li> </ul>	up to 20% on space heating	***	When making a building (façade) renovation or when renovating guest rooms.	<6 years	To be considered together with #32 and #35. Should be considered before #51, #52 and #46 (as it impacts space heating needs and ventilation needs).
	31	GENERAL	<ul style="list-style-type: none"> <li><u>Cavity wall insulation</u>: heat loss through cavity walls can be reduced by about two-thirds by filling the cavity with insulation. This can be either blown mineral wool, polystyrene beads or foam insulation.</li> </ul>	<ul style="list-style-type: none"> <li>The hotel has cavity walls that are not insulated.</li> </ul>	<ul style="list-style-type: none"> <li>Space heating</li> </ul>	up to 35% on space heating	**		<2-6 years	Should be considered before #51, #52 and #46.
	32	GENERAL	<ul style="list-style-type: none"> <li><u>External walls insulation</u>: insulation is best placed on the exterior of the wall (when feasible) as this makes it possible to:                             <ul style="list-style-type: none"> <li>- take advantage of the inertia of the walls (and thus reduce the temperature variations),</li> <li>- eliminate the cold bridges located at the junction with walls, floors and openings (these are responsible for heat loss).</li> </ul>                             Insulation can also be placed on the interior of the walls, but in this case thermal bridging issues must be carefully considered. Moreover, addition of internal insulation reduces the interior floor area available.                         </li> </ul>		<ul style="list-style-type: none"> <li>Space heating</li> </ul>	up to 20-50% on space heating when associated with roof insulation	***	When making a building (façade) renovation.	<5-10 years	To be considered together with #30. Should be considered before #51, #52 and #46, (as it impacts space heating needs and ventilation needs).

	33	GENERAL	<ul style="list-style-type: none"> <li>• <u>Roof thermal insulation</u></li> </ul>	<ul style="list-style-type: none"> <li>• The roof of the hotel has no proper insulation.</li> </ul>	<ul style="list-style-type: none"> <li>• Space heating</li> </ul>	up to 20-50% on space heating when combined with external walls insulation	***	When making a building (roof) renovation.	<5-7 years	
<i>Solution category</i>	<i>#</i>	<i>Hotel area</i>	<i>Energy Efficiency Solution</i>	<i>Initial situation required</i>	<i>End-usage</i>	<i>Potential energy saving</i>	<i>Easiness of implementation</i>	<i>Best moment to implement the solution</i>	<i>Pay back period</i>	<i>Link with other solutions</i>
► Reduce air infiltration	34	FRONT OFFICE	<ul style="list-style-type: none"> <li>• Install <u>automatic front doors</u>.</li> </ul>	<ul style="list-style-type: none"> <li>• The hotel has no automated front doors.</li> </ul>	<ul style="list-style-type: none"> <li>• Space heating</li> <li>• Space cooling</li> </ul>		**		Really depends on the initial situation	
	35	GENERAL	<ul style="list-style-type: none"> <li>• <u>Prevent air infiltration at windows and doors</u>: check weather stripping on windows and doors; eliminate all possible paths of uncontrolled air infiltration; replace leaky joints by waterproof joints.</li> </ul>		<ul style="list-style-type: none"> <li>• Space heating</li> <li>• Space cooling</li> </ul>		**		<1-8 years	To be considered together with #30.
<i>Solution category</i>	<i>#</i>	<i>Hotel area</i>	<i>Energy Efficiency Solution</i>	<i>Basic requirements / conditions</i>	<i>End-usage</i>	<i>Potential energy saving</i>	<i>Easiness of implementation</i>	<i>Best moment to implement the solution</i>	<i>Pay back period</i>	<i>Link with other solutions</i>
► Improve microclimate / protect the building from the summer sun	36	GENERAL	<ul style="list-style-type: none"> <li>• Install <u>shading devices</u> or <u>external movable sun-shading devices</u> for windows exposed to summer sun. Install interior shading as a last resort (it is less efficient).</li> </ul>	<ul style="list-style-type: none"> <li>• The hotel has space cooling needs in summer.</li> </ul>	<ul style="list-style-type: none"> <li>• Space cooling</li> </ul>		**	When making a building (façade) renovation or when renovating the hotel's rooms.	May be <5 years	To be considered together with #37.
	37	GENERAL	<ul style="list-style-type: none"> <li>• Consider <u>planting trees</u>, shrubs or local plants, for solar shading and for wind protection (deciduous trees for solar protection and coniferous trees for wind protection).</li> </ul>	<ul style="list-style-type: none"> <li>• The hotel has space cooling needs in summer.</li> </ul>	<ul style="list-style-type: none"> <li>• Space cooling</li> </ul>		**	When doing exterior works.	Varies greatly (good landscaping: may be less than 8 years)	To be considered together with #36.

	38	GENERAL	<ul style="list-style-type: none"> <li>• Install <u>open pools or fountains</u> for evaporative cooling.</li> </ul>	<ul style="list-style-type: none"> <li>• The hotel has space cooling needs in summer.</li> </ul>	<ul style="list-style-type: none"> <li>• Space cooling</li> </ul>		**	When making outside works.	Varies greatly	
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Equipment efficiency

Solution category	#	Hotel area	Energy Efficiency Solution	Basic requirements / conditions	End-usage	Potential energy saving	Easiness of implementation	Best moment to implement the solution	Pay back period	Link with other solutions
<p>► Better operational use of current equipment (through proper control &amp; regulation)</p>	39	GUEST ROOMS	<ul style="list-style-type: none"> <li>Thermostatic controls: install individual thermostatic controls in guest rooms, with proper upper and lower limits for temperature settings.</li> </ul>	<ul style="list-style-type: none"> <li>The hotel has no individual thermostatic control in guest rooms.</li> </ul>	<ul style="list-style-type: none"> <li>Space heating</li> <li>Space cooling</li> </ul>	up to 10-20% on space heating	*/**	When carrying out work on the space heating distribution system.	depends on guests' behaviour	To be considered together with #40.
	40	GUEST ROOMS	<ul style="list-style-type: none"> <li>Automatic control of heating and air conditioning in guest rooms:                             <ul style="list-style-type: none"> <li>Occupancy linked controls – these enable guest rooms to be isolated or heated to a “set-back” temperature, automatically, as guests enter or leave their rooms, or when they check in at reception.</li> <li>Automatic devices may also be used to switch off air conditioning and/or heating when windows or external doors are opened.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>The hotel has no automatic control of heating and air conditioning in guest rooms.</li> </ul>	<ul style="list-style-type: none"> <li>Space heating</li> <li>Space cooling</li> </ul>	up to 20-30% on space heating	**	When renovating guest rooms.	may be <1-3 years	To be considered together with #39.
	41	GUEST ROOMS	<ul style="list-style-type: none"> <li>Introduce low-flow showerheads in bathrooms to reduce hot water consumption.</li> </ul>		<ul style="list-style-type: none"> <li>Hot water</li> </ul>		*	Immediately	Varies	
	42	GUEST ROOMS	<ul style="list-style-type: none"> <li>Install key cards systems to switch off electricity when guest rooms are vacated.</li> </ul>	<ul style="list-style-type: none"> <li>The hotel has key card systems for guest rooms.</li> </ul>	<ul style="list-style-type: none"> <li>Lighting</li> <li>Usage of electricity</li> </ul>	up to 10% on electricity use	**	When renovating guest rooms.	may be <3 years (the larger the hotel, the shorter the pay back period)	To be considered together with #40.
	43	GENERAL	<ul style="list-style-type: none"> <li>Install a zone regulation for heating and regulate the set point and operating temperatures of the heating/cooling systems according to the actual needs (and occupancy) of different zones.</li> </ul> <p>Recommended temperatures:</p> <ul style="list-style-type: none"> <li>Normal heating (occupied spaces): 20-22°,</li> <li>Low heating (unoccupied short periods): 16-18°C,</li> <li>Stand-by heating (unoccupied</li> </ul>	The hotel has zones with different heating needs (ex. guest rooms, meeting rooms and offices...)	<ul style="list-style-type: none"> <li>Space heating</li> <li>Space cooling</li> </ul>	up to 8% on space heating and cooling	**	When renovating the heating system.	Varies	To be considered together with #51.

		<ul style="list-style-type: none"> <li>long periods): 12-14°C,</li> <li>- Normal cooling (occupied spaces): 25-26°C,</li> <li>- Low cooling (unoccupied short periods): 27-29°C,</li> <li>• Stand-by cooling (unoccupied long periods): 30-32°C.</li> </ul>							
44	GENERAL	<ul style="list-style-type: none"> <li>• <u>Lighting control</u>: Automatic devices are available that make switching off easier: <ul style="list-style-type: none"> <li>- time control can switch lights on and off at pre-set times, each day,</li> <li>- occupancy sensors can switch on lights when movement is detected and switch them off after pre-set period of inactivity.</li> <li>- photocell controls can switch or dim lights when there is adequate daylight available.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• The hotel has no lighting controls.</li> </ul>	<ul style="list-style-type: none"> <li>• Lighting</li> </ul>	Varies	*/**	Immediately	<1-8 years	To be considered together with #42 and #65.
45	GENERAL	<ul style="list-style-type: none"> <li>• <u>Lighting zone control</u> should be adopted, where applicable, to optimize electricity use.</li> </ul>		<ul style="list-style-type: none"> <li>• Lighting</li> </ul>	Varies	**		Varies	
46	GENERAL	<ul style="list-style-type: none"> <li>• <u>Ventilation control</u>: adjust outdoor air supply to avoid under-ventilation or over-ventilation (over-ventilation is a waste of energy in winter conditions, while under-ventilation may compromise the comfort and health of the occupants). <ul style="list-style-type: none"> <li>- Outdoor air supply control, such as the demand control method using CO2 sensors, can be adopted for effective ventilation and energy saving, especially in a large function room or similar spaces.</li> <li>- Economiser cycle can be adopted, where applicable, to utilise the cool outdoor air to reduce energy consumption for cooling.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• The hotel has a ventilation system.</li> </ul>	<ul style="list-style-type: none"> <li>• Space cooling,</li> <li>• Usage of electricity (ventilation )</li> </ul>	Varies	**/**	When renovating the ventilation system.	Varies	Should be considered after #30, #31, #32 and #33 (as insulation measures impact ventilation needs).

	47	GENERAL	<ul style="list-style-type: none"> <li>• <u>Water temperature regulation</u>: water temperature should be limited to 60°C.</li> </ul>		<ul style="list-style-type: none"> <li>• Hot water</li> </ul>		*	Immediately	<1 year	
	48	GENERAL	<ul style="list-style-type: none"> <li>• <u>Water temperature control</u>: hot water should be time and temperature controlled separately from the central heating system.</li> </ul>		<ul style="list-style-type: none"> <li>• Hot water</li> </ul>		**		Varies	
	49	GENERAL	<ul style="list-style-type: none"> <li>• Adopt an efficiency <u>peak load-management system</u> for electricity consumption to reduce peak demand (automatic regulator and capacitor banks should be installed for power factor improvement; this includes boilers, laundry and kitchen equipment and swimming-pool).</li> </ul>	<ul style="list-style-type: none"> <li>• The hotel has no peak load management system.</li> </ul>			**		Varies	
	50	SAUNA	<ul style="list-style-type: none"> <li>• Install a <u>sauna timer control</u>.</li> </ul>	<ul style="list-style-type: none"> <li>• The hotel has a sauna.</li> </ul>			*		<1 year	
<i>Solution category</i>	<i>#</i>	<i>Hotel area</i>	<i>Energy Efficiency Solution</i>	<i>Basic requirements / conditions</i>	<i>End-usage</i>	<i>Potential energy saving</i>	<i>Easiness of implementation</i>	<i>Best moment to implement the solution</i>	<i>Pay back period</i>	<i>Link with other solutions</i>
► <b>Improve heating efficiency (space heating and hot water production)</b>	51	GENERAL	<ul style="list-style-type: none"> <li>• Install <u>high efficiency equipment</u> for space heating and/or hot water production and/or space cooling: <ul style="list-style-type: none"> <li>- either efficiency boilers (condensing boiler, low temperature burner),</li> <li>- or efficiency air heat pumps,</li> <li>- or equipment that use partly or totally renewable energies (ground water or soil heat pumps, equipment using solar energy or biomass...).</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• The hotel is equipped with a boiler that is not efficient, or with electric radiators.</li> </ul>	<ul style="list-style-type: none"> <li>• Space heating</li> <li>• Hot water</li> </ul>	up to 25-35% on heating	**	When renovating the heating system.	<2-5 years	Should be considered after #30, #31, #32 and #33 (i.e. after energy conservation measures have been taken, cause they may reduce heating needs).



	52	GENERAL	<ul style="list-style-type: none"> <li>Install a <u>low temperature heating system</u> (e.g.: floor heating with maximum 50°C flow temperature, or low temperature radiator).</li> </ul>	<ul style="list-style-type: none"> <li>Heat for space heating is distributed with water pipes.</li> </ul>	<ul style="list-style-type: none"> <li>Space heating</li> </ul>	up to 25-35% on heating	***	When renovating the heating and distribution system.	Depends on the hotel situation	Should be considered together with #51.
	53	GENERAL	<ul style="list-style-type: none"> <li>Ensure <u>thermal insulation</u> of boilers, water systems, domestic hot water tanks and water pipes.</li> </ul>	---	<ul style="list-style-type: none"> <li>Space heating</li> <li>Hot water</li> </ul>	up to 4-9% on water heating	**/**	When renovating the hot water distrib. system.	may be <1 year	Should be considered after #51.
	54	GENERAL	<ul style="list-style-type: none"> <li>Consider installing a <u>hot water closed loop</u> to have hot water available close to the taps and to return hot water back to the water heater.</li> </ul>	---	<ul style="list-style-type: none"> <li>Hot water</li> </ul>		**	The hot water distribution pipes are long	Depends on the hotel situation	Should be considered after #51.
	55	GENERAL	<ul style="list-style-type: none"> <li>Local “instant” hot water heaters should be considered if very long pipe runs are currently needed; this will reduce heat loss in the long pipework as well as reducing water usage, by eliminating cold draw-off.</li> </ul>	<ul style="list-style-type: none"> <li>Domestic hot water is distributed through long water pipes.</li> </ul>	<ul style="list-style-type: none"> <li>Hot water</li> </ul>		**	The hot water distribution pipes are long		Should be considered after #51.
	56	GENERAL	<ul style="list-style-type: none"> <li><u>Heat recovery</u>: heat waste from air conditioning may be used to pre-heat the domestic water.</li> </ul>	<ul style="list-style-type: none"> <li>The hotel is equipped with an air-conditioning system.</li> </ul>	<ul style="list-style-type: none"> <li>Hot water</li> </ul>	Can lead to 15% saving on hot water production.	**		<15 years	
	57	GENERAL	<ul style="list-style-type: none"> <li><u>Alternative heat supply</u>: if an efficient district heating is available locally, the hotel may consider connecting.</li> </ul>	<ul style="list-style-type: none"> <li>District heating is available.</li> </ul>	<ul style="list-style-type: none"> <li>Space heating</li> <li>Hot water</li> </ul>		**/**	When renovating the heating system.		
<b>Solution category</b>	<b>#</b>	<b>Hotel area</b>	<b>Energy Efficiency Solution</b>	<b>Basic requirements / conditions</b>	<b>End-usage</b>	<b>Potential energy saving</b>	<b>Easiness of implementation</b>	<b>Best moment to implement the solution</b>	<b>Pay back period</b>	<b>Link with other solutions</b>
► <b>Improve space cooling efficiency</b>	58	GENERAL	<ul style="list-style-type: none"> <li>Install a <u>high efficiency cooling equipment</u> (which can be a cooling only equipment, or a cooling/ventilation equipment or heating/cooling equipment): <ul style="list-style-type: none"> <li>e.g.: centralized or semi-centralized cooling system.</li> <li>e.g.: high efficiency reversible heat pump.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>The hotel has space cooling needs in summer.</li> </ul>	<ul style="list-style-type: none"> <li>Space cooling</li> </ul>	Can result in as much as 50% saving on space cooling.	***	When renovating the cooling/ heating system.	<2-5 years	
	59	GENERAL	<ul style="list-style-type: none"> <li>Ensure <u>thermal insulation</u> of pipes and air ducts of the air conditioning system.</li> </ul>	<ul style="list-style-type: none"> <li>The hotel is equipped with an air-conditioning system.</li> </ul>	<ul style="list-style-type: none"> <li>Space cooling</li> </ul>		**/**			

	60	GENERAL	<ul style="list-style-type: none"> <li>Install <u>mill-type ceiling ventilators</u>.</li> </ul>	<ul style="list-style-type: none"> <li>The hotel has space cooling needs in summer.</li> </ul>	<ul style="list-style-type: none"> <li>Space cooling</li> </ul>	Depends on guest and staff behavi.			<1 year	
<i>Solution category</i>	<i>#</i>	<i>Hotel area</i>	<i>Energy Efficiency Solution</i>	<i>Basic requirements / conditions</i>	<i>End-usage</i>	<i>Potential energy saving</i>	<i>Easiness of implementation</i>	<i>Best moment to implement the solution</i>	<i>Pay back period</i>	<i>Link with other solutions</i>
► Improve ventilation efficiency	61	GENERAL	<ul style="list-style-type: none"> <li>Install an exhaust air <u>heat recovery system</u> in the air-handling unit.</li> </ul>	<ul style="list-style-type: none"> <li>The hotel is equipped with a double flux mechanical ventilation system.</li> </ul>	<ul style="list-style-type: none"> <li>Space heating</li> </ul>	Can lead up to 10% saving on space heating.	**		<10 years	
	62	GENERAL	<ul style="list-style-type: none"> <li>Install <u>new motors with variable frequency command</u> to activate ventilators, pumps and cooling systems.</li> </ul>	<ul style="list-style-type: none"> <li>Motors used to activate ventilators, pumps and cooling systems have no variable frequency command.</li> </ul>	<ul style="list-style-type: none"> <li>Usage of electricity (HVAC applications )</li> </ul>	up to 70% saving on electricity use.	**/**	When replacing the motors of HVAC applications.	<1-4 years	
	63	GENERAL	<ul style="list-style-type: none"> <li>Ensure <u>thermal insulation</u> of air ducts.</li> </ul>		<ul style="list-style-type: none"> <li>Usage of electricity (ventilation)</li> </ul>		**/**		Varies	
	64	LAUNDRY AND KITCHEN	<ul style="list-style-type: none"> <li>Consider use of <u>variable-speed extraction systems</u> to reduce the energy waste by adjusting the fan speed to the rate of extraction required.</li> </ul>		<ul style="list-style-type: none"> <li>Usage of electricity (ventilation)</li> </ul>		**/**		supply-exhaust system: <12 years	
<i>Solution category</i>	<i>#</i>	<i>Hotel area</i>	<i>Energy Efficiency Solution</i>	<i>Basic requirements / conditions</i>	<i>End-usage</i>	<i>Potential energy saving</i>	<i>Easiness of implementation</i>	<i>Best moment to implement the solution</i>	<i>Pay back period</i>	<i>Link with other solutions</i>
► Improve lighting efficiency	65	GENERAL	<ul style="list-style-type: none"> <li>Use <u>high efficiency fluorescent tubes</u> and <u>electronic ballasts</u> in areas lit for long hours, where applicable, to improve efficacy (e.g.: in corridors).</li> <li>Use <u>LED exit signs</u>.</li> </ul>	<ul style="list-style-type: none"> <li>The hotel has no energy saving light bulbs.</li> </ul>	<ul style="list-style-type: none"> <li>Lighting</li> </ul>	up to 75%	*		<1-3 years	To be considered together with #42 and #44.
► Improve (other) electric equipment efficiency	66	KITCHEN	<ul style="list-style-type: none"> <li>Connect dishwashers to warm water supply.</li> </ul>	<ul style="list-style-type: none"> <li>The hotel has a kitchen.</li> </ul>	<ul style="list-style-type: none"> <li>Specific usage of electricity</li> </ul>		*			
	67	LAUNDRY	<ul style="list-style-type: none"> <li><u>Ozone laundry</u> (mostly in the US).</li> </ul>	<ul style="list-style-type: none"> <li>The hotel has a laundry.</li> </ul>	<ul style="list-style-type: none"> <li>Hot water production</li> </ul>	75% savings on hot water production			<1-2 years	
	68	LAUNDRY	<ul style="list-style-type: none"> <li>Connect washing machines to warm water supply.</li> </ul>	<ul style="list-style-type: none"> <li>The hotel has a laundry.</li> </ul>	<ul style="list-style-type: none"> <li>Specific usage of electricity</li> </ul>			*		

	69	GENERAL	<ul style="list-style-type: none"> <li>Choose electrical appliances with <u>high energy efficiency ratings</u> (catering equipment, refrigerators and freezers, dishwashers, laundry and office equipment, etc.).</li> </ul>	<ul style="list-style-type: none"> <li>Some electrical appliances are more than 5 years old.</li> </ul>	<ul style="list-style-type: none"> <li>Specific usage of electricity</li> </ul>		*	When replacing electrical equipment.	<1-8 years	
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# 20 key energy efficiency solutions for SME hotels

## Overview menu of 20 key energy efficiency solutions suitable for use in SME hotels

The following table provides an overview of the solutions which have been identified as key energy efficiency solutions for SME hotels.

Key solutions for better energy efficiency in your hotel	
<b>Make a first assessment</b>	
- to identify improvement opportunities in your hotel	
	I. Energy consumption monitoring
	II. Energy audit of the hotel
	III. Audit for the European Eco-label for tourist accommodation service
<b>Involve your staff</b>	
- to ensure maximum energy savings and success of your action plan	
	IV. Staff training
<b>Involve your guests</b>	
- to let them know you care for the environment and to ensure maximum energy savings	
	V. Information to guests
<b>Protect the building from the cold &amp; hot weather</b>	
- to reduce heating & cooling needs and improve comfort	
▶ the building	VI. Window insulation VII. Building insulation VIII. Prevention of air infiltration and of unnecessary outdoor air supply IX. Installation of sun protectors
▶ the exterior	X. Outside works to improve summer comfort
<b>Improve equipment efficiency</b>	
- to reduce energy costs and improve the quality of your services	
▶ control of electrical equipment	XI. Key card systems to switch off electricity in guest rooms XII. Lighting controls
▶ replacement of electrical equipment	XIII. Energy saving light bulbs XIV. Energy efficiency rating of electrical appliances XV. Motors with variable frequency command in HVAC applications
▶ regulation of space heating and cooling	XVI. Regulation of space heating and cooling
▶ renovation of heating equipment	XVII. High efficiency boilers XVIII. Thermal insulation of boilers, water systems, domestic hot water tanks and water pipes
▶ renovation of space cooling equipment	XIX. Efficiency solutions for active space cooling
▶ renovation of the ventilation system	XX. Efficiency ventilation systems (regulation & pre-heating)

Information on what is covered by each individual solution is provided in the table below (the detailed description of the solutions are provided in a separate document called “Energy Efficiency Solutions Database”).

		What is it about?
<b>Make a first assessment</b>		
	<b>I. Energy consumption monitoring</b>	<p>The objective is to raise the hotelier’s awareness of the importance of energy monitoring, to provide him with a simple strategy to monitor the hotel energy consumption, and to explain what key questions he should ask regarding the hotel’s energy consumption.</p> <p>The installation of sub-meters is mentioned as a possible option.</p>
	<b>II. Energy audit of the hotel</b>	<p>The objective is to encourage the hotelier to have an energy audit made of his hotel and to describe briefly the steps and objectives of an energy audit.</p>
	<b>III. Audit for the European Eco-label for tourist accommodation service</b>	<p>The objective is to raise the hotelier’s awareness about the European Eco-label by providing information on its requirements and on the application procedure.</p> <p>Information will also be given on energy-related criteria.</p>
<b>Involve your staff</b>		
	<b>IV. Staff training</b>	<p>The objective is to raise the hotelier’s awareness of the importance of involving his staff in order to ensure maximum energy savings and the success of the action plan.</p> <p>The following information/training areas will be suggested:</p> <ul style="list-style-type: none"> <li>- awareness of the environmental impact of hotels,</li> <li>- awareness of the different ways the staff can contribute to energy conservation (examples of good housekeeping practices will be given, importance of preventive equipment maintenance will be underlined).</li> </ul>
<b>Involve your guests</b>		
	<b>V. Information to guests</b>	<p>The objective is to provide advice to the hotelier on:</p> <ul style="list-style-type: none"> <li>- how to inform guests about the energy policy,</li> <li>- which good practices he should encourage the guests to follow regarding space heating, window opening, switching lights off, etc..</li> </ul>
<b>Protect the building from temperature extremes</b>		
▶ the building	<b>VI. Window insulation</b>	<p>The objective is to raise the hotelier’s awareness of the importance of having properly insulated windows, and to advise him on how to choose appropriate glazing and joinery.</p>
	<b>VII. Building insulation</b>	<p>The objective is to raise the hotelier’s awareness of the importance of having a well-insulated building (roof, exterior walls...), to inform him on the different types of insulation techniques that can be applied (in particular for exterior walls) and on the precautions to take when insulating a building (ventilation, etc.).</p>
	<b>VIII. Prevention of air infiltration and of unnecessary outdoor air supply</b>	<p>The objective is to provide simple advice on how to reduce air infiltration at windows and doors.</p> <p>The installation of an automatic front door and of forced air curtains in loading bays will also be mentioned as possible options.</p>

	<b>IX. Installation of sun protectors</b>	<p>The objective is to raise the hotelier's awareness of the benefits the hotel can draw from installing sun protectors to increase comfort as well as to reduce energy consumption).</p> <p>The hotelier will be advised on the correct choice of protectors.</p>
► the exterior	<b>X. Outside works to improve summer comfort</b>	<p>The objective is to suggest some exterior renovations that can be done to improve summer comfort and reduce the hotel's cooling needs.</p> <p>The solutions that will be mentioned include: indigenous shrub, plant and tree planting, installation of open pools or fountains for evaporative cooling.</p>

### Improve equipment efficiency

► control of electrical equipment	<b>XI. Key card systems to switch off electricity in guest rooms</b>	The objective is to encourage the hotelier to install key card systems to switch off electricity in guest rooms, and to describe the principle of these systems.
	<b>XII. Lighting controls</b>	<p>The objective is to encourage the hotelier to install lighting controls where appropriate, and to explain the different systems that are available for lighting controls.</p> <p>Timers, occupancy sensors and photocell controls will be mentioned as possible options.</p> <p>Good housekeeping practices (manual switch off/on) will also be mentioned as possible, complementary solutions.</p>
► replacement of electrical equipment	<b>XIII. Energy saving light bulbs</b>	The objective is to encourage the hotelier to install efficiency light bulbs (where appropriate) and to show the different energy saving light bulbs that are available on the market.
	<b>XIV. Energy efficiency rating of electrical appliances</b>	<p>The objective is to raise the hotelier's awareness of the importance of choosing electrical appliances with high energy efficiency rating.</p> <p>The types of equipment mentioned will include: catering equipment, refrigerators and freezers, dishwashers, laundry and office equipment.</p>
	<b>XV. Motors with variable frequency command in HVAC applications</b>	The objective is to raise the hotelier's awareness of the electricity consumption by the motors on ventilators, compressors and pumps and to encourage the hotelier to choose motors with variable frequency command when applicable.
► regulation of space heating and cooling	<b>XVI. Regulation of space heating and cooling</b>	<p>The objective is to raise the hotelier's awareness of the importance of regulating space heating and air-conditioning, and to suggest different solutions to ensure appropriate regulation.</p> <p>The solutions mentioned will include: installation of thermostats, installation of individual thermostatic valves, temperature setting for upper and lower limits of thermostats, occupancy linked controls and automatic controls of air conditioning and heating systems.</p> <p>Good housekeeping practices (manual temperature setting according to the actual occupancy of the different zones) will also be mentioned as a possible, complementary solution.</p>
► renovation of heating equipment	<b>XVII. High efficiency boilers</b>	<p>The objective is to present energy efficiency boilers that can be used for the production of hot water (for space heating and sanitary hot water).</p> <p>The solutions mentioned will include: high efficiency boilers, condensing boilers, low temperature boilers. Note: Equipment that use renewable energies for heat production (heat pumps, equipment using solar energy or biomass) are renewable energy solutions and will not be mentioned in the present review of energy efficiency solutions.</p>

	<b>XVIII. Thermal insulation of boilers, water systems, domestic hot water tanks and water pipes</b>	The objective is to encourage the hotelier to insulate the hot water distribution and storage systems and thus prevent unnecessary heat losses.
► renovation of space cooling equipment	<b>XIX. Efficiency solutions for active space cooling</b>	The objective is to present equipment that can be used for active space cooling and to encourage the hotelier to choose systems with high energy efficiency rating.  The solutions mentioned will include: individual systems (air-to-air split systems), central or semi-central air conditioning systems and heat pumps.
► renovation of the ventilation system	<b>XX. Efficient ventilation systems (regulation &amp; pre-heating)</b>	The objective is to present ventilation solutions that will reduce heat losses in winter while maintaining good air quality. Improvement of summer comfort will also be mentioned.

## Criteria used for the selection of the 20 key energy efficiency solutions

The following criteria have been used for choosing the 20 key energy efficiency solutions:

- **type of solutions:** a mix of technological solutions and energy management methods have been selected; and, as seen, the technological solutions prevail (numerically) given that energy conservation measures often involve some technical intervention. It should be noted these energy management methods are essential for a successful solution and should not be discounted;
- **energy consuming activities considered:** we have focused on end-usages which consume the most energy in the hotel sector, mainly:
  - **space air conditioning** (heating/cooling, ventilation and air-conditioning): this is the largest single end-user of energy in hotels, accounting for approximately half of total consumption;
  - **lighting:** lighting fluctuates between 12-18% and up to 40% of a hotel's total energy consumption, depending on the category of the establishment;
  - **domestic hot water:** domestic hot water accounts for up to 15% of the total energy demand.
- **benefits provided:** we have focused on solutions which have the potential to reduce energy consumption significantly, and are well known not only for reducing energy consumption, but also for increasing comfort when implemented correctly.
- **ease of implementation and cost:** some of the solutions presented are easily implemented and require little investment, whereas others require a more significant investment. By choosing solutions that present different levels of difficulty, our intention is to identify solutions with various time frames (some hotels may not be able to invest in or carry out some important renovations in the short term, but may be interested in implementing a few "immediate" actions).

# A solution to create additional strategies for improving energy efficiency in a small hotel

The way in which a hotel's energy efficiency can be improved over time depends on the particular situation of the hotel, such as the building's characteristics, the available budget, future renovation plans, etc.). In order to give an hotelier an idea of the incremental strategies which could be adopted to improve the energy efficiency of a SME hotel, we suggest the three following scenarios:

- **Scenario 1 – “What can my hotel do immediately?”:**

The hotelier is invited to identify energy saving opportunities (through energy monitoring and an energy audit) so as to be able to begin considering possible solutions which can be implemented before starting renovations (staff training, information to guests, installation of energy saving light bulbs and of electrical appliances with high energy efficiency rating).

- **Scenario 2 – “What will my hotel achieve with these small renovations?”:**

Additional suggestions to improve the hotel's energy efficiency are: “room controls” (these reduce energy use in guest rooms taking into account the actual occupancy of the rooms), regulation of heating and cooling in the building, installation of motors with variable frequency command in HVAC applications, optimization of lighting throughout the building (through lighting controls), thermal insulation of hot water systems (to improve efficiency of space heating and hot water production) and installation of a hot water closed loop (if appropriate), prevention of unnecessary outdoor air leakage through doors and windows, exterior renovations to improve summer comfort.

- **Scenario 3 – “What can my hotel include during an extensive renovation?”:**

The third scenario includes measures which require important renovations, either on the exterior of the building (thermal insulation of the building, window replacement, installation of shading materials on the outside walls) or on space heating/cooling/ventilation equipment and distribution systems.

This scenario is recommended, for example, when the hotel changes hands and extensive renovations are planned.



These three scenarios are illustrated in the table below:

		Scenario 1	Scenario 2	Scenario 3	
		“What can my hotel do immediately?”	“What will my hotel achieve with these small renovations?”	“What can my hotel include during an extensive renovation?”	
<b>Legend:</b>					
			Recommended solution for each scenario.		
<b>Make a first assessment</b>					
	I. Energy consumption monitoring II. Energy audit of the hotel III. Audit for the European Eco-label for tourist accommodation service				
<b>Involve your staff</b>					
	IV. Staff training				
<b>Involve your guests</b>					
	V. Information to guests				
<b>Eco-renovate</b>					
▶ the building	VI. Window insulation VII. Building insulation				
	VIII. Prevention of air infiltration and of unnecessary outdoor air supply				
	IX. Installation of sun protectors				
▶ the exterior	X. Exterior work to improve summer comfort				
<b>Improve equipment efficiency</b>					
▶ control of electrical equipment	XI. Key card systems to switch off electricity in guest rooms XII. Lighting controls				
▶ replacement of electrical equipment	XIII. Energy saving light bulbs XIV. Energy efficiency rating of electrical appliances				
	XV. Motors with variable frequency controls in HVAC applications				
▶ regulation of space heating and cooling	XVI. Regulation of space heating and cooling				
▶ renovation of heating equipment	XVII. High efficiency boilers				
	XVIII. Thermal insulation of boilers, water systems, domestic hot water tanks and water pipes				
▶ renovation of space cooling equipment	XIX. Efficient solutions for active space cooling				
▶ renovation of the ventilation system	XX. Efficient ventilation systems (regulation & pre-heating)				

# Key to the database on the 20 energy efficiency solutions ■

## General information provided for each energy efficiency solution

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Each of the 20 energy efficiency solutions will be described in a datasheet containing the following information:

- **solution category:** the solution category (Make a first assessment / Involve your staff / Involve your guests / Eco-renovate / Improve equipment efficiency) is specified at the beginning so the hotelier quickly identifies the type of solution;
- **general information on the solution:** some “pre-information” will be given before the full description of the solution – namely:
  - **area of the hotel concerned:** this will be indicated should the solution be relevant to a specific area of the hotel (guest rooms, kitchen...) or if it concerns the entire building (in this case, the term “general” is used);
  - **energy consuming activities (or end-usage) concerned:** this will indicate which energy consuming activities are impacted by the solution (space heating, space cooling, hot water, lighting, etc.);
  - **related criteria of the EU Eco-label:** reference to the criteria of the EU Eco-label will be provided for solutions relating to the criteria;
  - **ease of implementation:** this will indicate the level of difficulty for implementing the solution: from easy (\*) to moderate (\*\*) and difficult (\*\*\*);
  - **ideal time to implement the solution:** when relevant, an indication will be provided on the best moment to implement the solution;
  - **basic requirements /conditions:** this provides basic information on the conditions that must be verified by the hotelier for the solution to be applicable/relevant for the hotel;
  - **indicative cost:** the cost of the solution may vary greatly from one country to another, but an indicative cost will be given when such information is available.
  - **return on investment:** an indicative time frame of when one might expect a return on investment, expressed in a range of years, whether the solution has a quick return (< 5 years) or a slower longer (10-20 years); it is important to note that the numbers given are only indicative and in some cases it is not possible to give this information (either because it is not available or because it is not applicable).
- **description of the solution:** after the pre-information, the fundamental part of the solution will be described, together with the main products available (when applicable); recommendations for the implementation of the solution will be provided: in addition, an indication will be given on which other energy efficiency solutions should be considered at the same time.
- **benefits for the hotel:** this will provide information on the benefits of the solution (potential energy saving, potential reduction of CO2 emissions, improvement of indoor comfort, etc.).
- **market availability:** the maturity?? of the solution will be indicated and key manufacturers and suppliers identified.

## *Example of template*

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The template used to describe the solutions is presented below.

# Hotel Energy Solutions

## Name of the solution

### General Information on the solution

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Target  
Related criteria of the EU Eco-label  
About its implementation  
Cost Indicative return on investment time

### Benefits for the hotel

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Cost reduction

### Benefits for the environment

---

Carbon emissions reduction

### Description of the solution

---

Principle  
Recommendations

### Market availability

---

## *EE solutions database*

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The database of energy efficiency solutions (the 20 datasheets) is provided in a separate document.

# Propose priority interventions



In addition to suggesting three possible scenarios for energy efficiency improvements (scenario 1: “What can my hotel do right away?”; scenario 2: “What will my hotel achieve with these small renovations?”; scenario 3: “What can my hotel include during an extensive renovation?”), we suggest a “solution provider” be developed, based on the information contained in the 20 key EE solutions datasheets, to inform SME hotel managers on the energy efficiency solutions available..

## Principle of the “solution provider”

The solution provider may also provide access to the descriptions of the 20 key energy efficiency solutions (the 20 datasheets) and offer the hotelier the possibility to research energy efficiency solutions according to relevant criteria, such as ease of implementation, ideal timing to implement the solution, etc.

### *Recommendations regarding the solution provider’s functionality*

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**For the ‘solution provider’ to be flexible and easy to use for a hotelier, we have carried out a multi-criteria research which is available in the solution provider.**

The following possible parameters could be used as entries in the multi-criteria research:

- (1) area of the hotel concerned,
- (2) energy consuming activities (or end-usage) concerned,
- (3) ease of implementation,
- (4) cost of solution (when available)

Together with the solution “domain”:

- Make a first assessment,
- Involve your staff,
- Involve your guests,
- Protect the building from temperature extremes,
- Improve equipment efficiency

These are to be intuitive for an hotelier and will help him select the appropriate solution.

### *Using the “solution provider”: various possible methods to identify priority situations*

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In addition to the three possible scenarios (scenario 1: “What can my hotel do right away?”; scenario 2: “What will my hotel achieve with these small renovations?”; scenario 3: “What can my hotel include during extensive renovation?”), the hotelier could make a multi-criteria research of solutions to identify the priority interventions for his hotel.

Below is an illustration of the different ways a hotelier could use the solution provider in order to identify priorities. In the example, it is assumed that the hotelier fills in a simple questionnaire with the hotel’s characteristics before using the solution provider, and that the toolbox can analyse this information to provide an appropriate solution.

**Example 1:** An approach which could be followed by the hotelier to identify priorities and obtain information on energy efficiency solutions suitable for his hotel.

## 1. First filter: end-usage

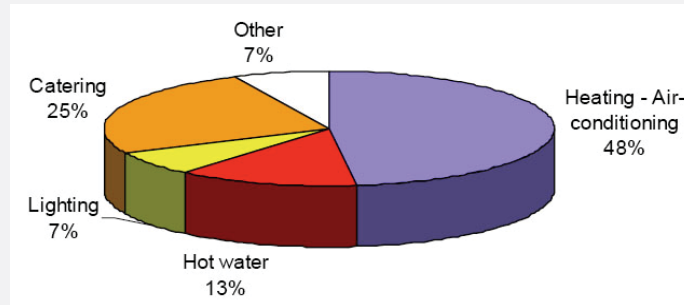


Figure 1. Breakdown of energy consumption in European hotels. (Source : XENIOS Managers guide, 2001 - from IMPIVA, 1994)

- **Example:** (hotelier): “I want to know which solutions are available to reduce energy used for lighting” The hotelier applies a first filter on the [end-usage](#).

The toolbox provides a [list](#) of solutions that can reduce the hotel’s energy consumption for lighting.

The toolbox takes into account the information provided by the hotelier on the hotel characteristics to know if the solution is [applicable/relevant](#) to him (automatic filter on the ‘initial situation required’).

## 2. Complementary information: feasibility & benefits

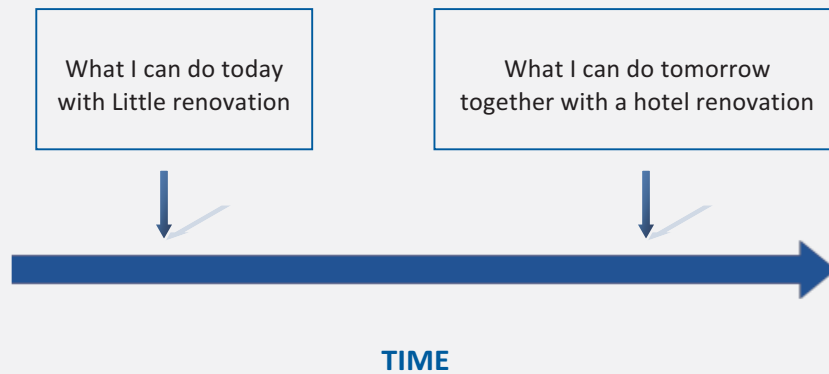
- **Example:** (hotelier): “I want to know the feasibility of the solution and the benefits that I can draw from the solution”.

The hotel manager asks for detailed information on the solutions that seem of interest to him. He opens the corresponding datasheets and can read about:

- The ease of implementation of the solution,
- the estimated [benefits](#) (when available),
- the [best moment](#) to implement the solution (when relevant),
- the [other solutions](#) that should be considered in the meanwhile to ensure coherence,
- etc.

**Example 2:** An approach that could be used by the hotelier to identify priorities and obtain information on energy efficiency solutions that are suitable for his hotel.

### Ranking solutions by ease of implementation



- Example: (hotelier): *"I want to know which energy efficiency solutions I can implement:*
  1. **today**, with little renovation,
  2. **tomorrow**, together with an extensive hotel renovation.
- *Moreover, I want to know the benefits I can get from these solutions, and if there is an order of priority to consider to ensure consistency".*
  - The hotel manager applies a first filter on the ease of implementation

The toolbox provides a list of energy efficiency solutions that can be implemented:

1. **today** (\*): *almost all the solutions dealing with energy management and some solutions dealing with equipment regulation and with the replacement of electrical equipment (lighting, laundry, etc.)*
2. **tomorrow** (\*\*/\*\*): *almost all the solutions that aim at improving the thermal characteristics of the building and most solutions that deal with the replacement of HVAC equipment (heating, ventilation and air conditioning).*

The toolbox takes into account the information provided by the hotelier on the hotel characteristics to know if the solution is applicable/relevant to him ('basic requirements/ conditions').

The hotelier asks for detailed information on the solutions that seem of interest to him. He opens the corresponding datasheets and can read about:

- relationships to other solutions,
- the energy consuming activity (end-usage) that can be improved with the solution (space heating, space cooling, etc.),
- the estimated benefits (when available).

**A third way** to use the toolbox could consist of selecting the solutions that apply to a specific area of the hotel (example: guest rooms) should the hotelier be planning to carry out renovation works in a specific area of the hotel.

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