Sustainability standards and their impact on the interior design of green hotels

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Abstract:

Sustainable buildings are defined as those that have minimum harmful impacts on the built and natural environment. The most effective, sustainable designs should promote health and well-being, harvest their own water and energy needs, be adaptable to cite climate and be able to evolve as weather conditions change, and they should operate without polluting the environment and generate no waste. It's also a plus when these buildings appear beautiful and inspire innovation and creativity.

Environmental sustainability in the hospitality industry refers to the balance that must exist between an activity and the environment in which it is developed, where the two interact without being detrimental to each other, it is argued that environmental issues in the hospitality industry should include water and energy efficiency and conservation, climate change and greenhouse gas emissions, waste management and recycling, bio-diversity and the protection of natural resources, the reduction of environmental impacts, environmentally responsible sourcing and the creation of green construction standards for new hotel construction.

The research dealt with the definitions and importance of green hotels, as well as some sustainability criteria in hotels, Popular and reputable operational certifications, Popular and reputable building certifications, Benefits of certification, Types of certification and also it dealt with a study and details about the LEED criterion as What is LEED? Why LEED? LEED Points Scale, Fulfillment, LEED v4.1 is the next generation standard for green building design, construction, operations and performance.

At the end of the research, the Alma Verde Hotel, Luz Lagos, (Portugal) has been analyzed, with the environmental sustainability criteria that was used in the design and construction of the hotel.

Keywords:

Hotels, Green hotels, Sustainable, Energy Efficiency, LEED, BREEAM, Renewable Energy

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Introduction: -

Tourism is one of the largest and rapidly growing industry among various industries in the world, which improves the economy by bringing in job opportunities, knowing the understanding of foreign cultures and natural heritage and infrastructural investments.

The term "green hotels" describes hotels that strive to be more environmentally friendly through the efficient use of energy, water, and materials while providing quality services. Green hotels conserve and preserve by saving water, reducing energy use, and reducing solid waste (Sarah Alexander).

Sustainability is currently a major pursuit in many industries, including the hospitality industry, where it is a vital issue for industry development (Shen, L.; Qian, J.; Chen, S.C).

Although different scholars have illustrated that the rapid growth of the hotel industry contributes significantly to environmental degradation worldwide, as hotels consume a large amount of energy and water for heating, cooling and lighting, which negatively influences the environment, some hotels have implemented environmental policies to specifically promote environmental preservation in the hope of improving the quality of human lives (Abdel-Maksoud, A.; Kamel, H.; Elbanna, S).

The growing interest in the principles of sustainable development, and the resulting pressure from the media, government and consumer sources to increase activity levels in this area, is forcing many hotels to increasingly implement practices that are more environmentally friendly.

Bender examined the results of a survey conducted by Trip Advisor and stated that around two thirds (62%) of travelers consider environmental issues when deciding to stay at a hotel (Bender).

Hotels benefit from implementing sustainable practices from two perspectives: firstly, the implementation leads to the improvement of resource efficiency and savings related to energy and water consumption; secondly, this functions as a marketing tool for attracting customers interested in sustainability (Erdogan, N.; Baris, E).

Environmental sustainability in the hospitality industry refers to the balance that must exist between an activity and the environment in which it is developed, where the two interact without being detrimental to each other, it is argued that environmental issues in the hospitality industry should include water and energy efficiency and conservation, climate change and greenhouse gas emissions, waste management and recycling, bio-diversity and the protection of natural resources, the reduction of environmental impacts, environmentally responsible sourcing and the creation of green construction standards for new hotel construction. Recently, the question of how to manage these aspects has become a priority due to the growing environmental awareness across society in general and among tourists in particular (Jones, P.; Hillier, D) [33].

There are many definitions for “Green practices” in the hospitality industry that are varied and associated with different approaches as; Wolfe and Shanklin, green hotel practices refer to measures that eliminate the negative impact on the environment, i.e., recycling and eco-purchasing. According to Kim, Lee &Fairhurst have defined green practices as “a value-added business strategy that benefits a hospitality operation that engages in environmental protection initiatives”. Manaktola and Jauhari [38] (p. 365) have defined it as “a less

environmentally damaging property which has made a commitment to various ecologically sound practices such as saving water, saving energy, and reducing solid waste".
Similarly, Rahman, Reynolds &Svaren have defined "green" as "environmentally friendly, that is doing business in a way that reduces waste, conserves energy, and generally promotes environmental health". Myung, McClaren& Li stated that green practices aim to reduce the negative impact on the environment by adopting environmental measures for reducing waste and using sustainable materials and resources. In a similar manner, "green hotels" are defined as "environmentally-friendly properties whose managers are eager to institute programs that save water, save energy, and reduce solid waste—while saving money—to help protect our one and only earth".

Research Question:

1. How the negative impact of tourism development can gradually destroy the environmental resources on which it depends on, how can the existing hotels be converted to sustainable and green hotels?
2. Lack of comprehensive knowledge about the nature of technological treatments and modern technologies that a designer can follow when using renewable energy, especially solar cells, as a material used in the design of hotels.
3. How can the buildings which are responsible for half of the world's total energy consumption, and for half of the resulting carbon dioxide emissions be converted for environmentally friendly buildings?

Research Aims:

1. The aim of the research is to identify the different aspects of hotels that can reduce their harmful impact on the environment.
2. Clarify the importance ofusing renewable energy, especially solar cells, and using it as an auxiliary solution to the energy problem in hotels with its economic feasibility.

Methodology:

The research follows the descriptive analytical method, which is based on presenting a model of green hotels that have applied environmental sustainability standards.

Popular and reputable operational certifications

- Global Sustainable Tourism Council (GSTC) Criteria were designed to take sustainable tourism guidelines and standards from around the world into account, the GSTC criteria focus on sustainable management, socioeconomic impacts, cultural impacts and environmental impacts. They also recognize various hotel certification schemes around the world which are equivalent to GSTC certification. The full list can be found on their website.
- Earth Check uses internationally recognized criteria to report on management performance covering a wide range of areas including environment, risk and quality management.
- Green Globe includes 44 core criteria focused on areas such as sustainable management, social/economic, cultural heritage and the environment.

- Green Key represents a commitment by businesses that their premises adhere to the environmental responsibility and sustainable operation criteria set by the Foundation for Environmental Education (FEE).
- Travel life Accommodation Sustainability criteria cover environmental, social and economic business impacts.
- EU Eco label or EU Flower is awarded to products and services that have a lower environmental impact than comparable products and services.

Popular and reputable building certifications

- LEED assesses against areas such as energy and water efficiency, used materials, indoor air quality and awareness and education.
- BREEAM has nine criteria including energy, health and wellbeing, ecology and waste.
- EDGE certifies buildings based on their on-site energy savings and it includes a certification for zero carbon.

Benefits of certification

All buildings, such as hotels, can have a major impact on the environment throughout their lifecycle. Energy, water and other natural resources (such as timber, cotton and food) are required, and waste is produced during the construction and use of a building.

With many countries and companies pledging to achieve net zero carbon emissions, sustainable construction and management of buildings will play an important role in achieving these goals. Following a certification process will help hotel properties to identify and implement ways to improve their impact across a range of sustainability criteria.

Types of certification

There are two different types of certifications that are relevant to hotels:

1. Environmental certifications for the building itself, with different versions for new builds versus existing buildings. Examples include LEED and BREEAM.
2. Environmental certifications for how a hotel is operated. Examples include Green Key, Green Globe, ISO 14001 and EU Eco label.

What is LEED?

LEED stands for “Leadership in Energy and Environmental Design,” and it is an independent, non-profit, third-party rating system established by the U.S. Green Building Council (USGBC) in 1998. The LEED rating system is completely voluntary and consensus-based, incorporating both established industry principles and innovative environmental technology.

LEED is the most widely-recognized form of green building certification in the United States.

Why LEED?

LEED is the international standard for green buildings. LEED certified buildings are recognized by facilities, consumers and the media as the most energy efficient and occupant-

friendly structures in the world. The primary reason most hotels seek LEED is operational efficiencies.

According to Green tech Media, while the average LEED new construction costs $3 more per square foot to build, that same building reaps $73 per square foot in energy savings.

Businesses occupying LEED certified buildings not only earn savings from lower operating costs; they also increase revenue from their "greener" profile. For example, the Watkins Research Group found that "green" qualities are an important factor for meeting planners when choosing venues.

There are innumerable advantages associated with LEED certified buildings.

LEED Points Scale

LEED operates on a 100-point scoring system. Both new and existing construction can seek certification. A property must meet a minimum of 40 of these points to attain certification. There are also a set of mandatory prerequisites which carry no points themselves, but must be achieved before points are awarded. Buildings can qualify for four levels of certification, based on the number of points achieved in the 100-point scale:

1. Certified: 40–49 points
2. Silver: 50–59 points
3. Gold: 60–79 points
4. Platinum: 80–110 points

Fulfillment

The 100 possible points come from exceeding standards in seven different categories:

1. Sustainable Sites 14 points 20%
2. Water Efficiency 5 points 7 %
3. Energy and Atmosphere 17 points 25%
4. Materials and Resources 13 points 19 %
5. Indoor Environmental Quality 15 points 22 %
6. Innovation in Operations 5 points 7 %
7. Regional Bonus Points (FIG. 1).

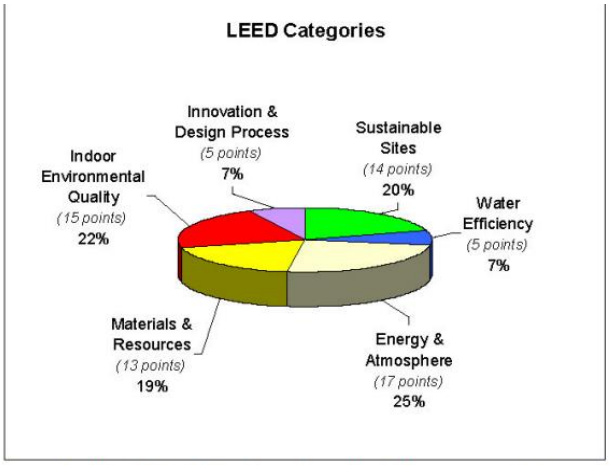


Figure 1: The LEED Pie (based on the US system of 69 points)

LEED v4.1 is the next generation standard for green building design, construction, operations and performance

LEED helps buildings to focus on efficiency and leadership to deliver the triple bottom line returns of people, planet and profit. Today's version of LEED, LEED v4.1, raises the bar on building standards to address energy efficiency, water conservation, site selection, material selection, day lighting and waste reduction.

LEED is the world's leading green building project and performance management system, delivering a comprehensive framework for green building design, construction, operations and performance:

- The rigorous focus on material selection, human comfort, air quality and human health features of a building rightly prioritizes the most important asset of the building: human beings.
- The specific focus on social equity ensures that buildings are not considered in isolation of their communities but prioritize access and inclusiveness for all.
- To ensure a building is resilient from natural and unnatural disturbances a comprehensive set of design and construction strategies has been established in LEED v4.1.

LEED v4.1:

- Ensures that all building stakeholders – developer, property manager, occupant and the community benefit from sustainable design, construction, operations and performance.
- Supports projects to implement sustainable and healthy building practices to realize environmental, economic, social and community benefits for decades to come.
- Emphasizes integrative design to ensure better design, translation of design into high quality construction, optimize operations and high performance of a building.
- Helps buildings deliver higher quality beyond market practices by incorporating innovative design, technologies, construction and material selection strategies.
- Focuses on both performances oriented sustainable strategies and outcomes.
- Helps buildings consume fewer resources, reduce operating costs, increase value and create safer and healthier environments for its occupants.
- Helps buildings reduce their GHG/carbon emissions.
- Helps buildings use toxin free materials to deliver cleaner indoor air to improve productivity, focus and reduce respiratory illnesses of its occupants.
- Prioritizes sustainable materials, helping manufacturers to design, produce and deliver building materials that reduce a building's environmental impact. LEED v4.1 also helps manufacturers reduce energy, water, waste during manufacturing, carbon footprint during distribution and transportation and overall carbon emissions through the entire production lifecycle.

LEED v4.1 Operations + Maintenance

The first step in launching LEED v4.1 included a version of the LEED rating system for existing buildings. This rating system is for buildings that are fully operational and occupied for at least one year. The project may be undergoing improvement work or little to no construction. The entire building's gross floor area must be included in the project.

- Existing Buildings. Existing whole buildings.
- Existing Interiors. Existing interior spaces that are contained within a portion of an existing building. Interior spaces may serve commercial, retail or hospitality purposes.

Option 2: Material Ingredient Optimization (1 point)

▪ Use products that have a compliant material ingredient optimization report or action plan. Use at least 5 permanently installed products sourced from at least three different manufacturers. Products are valued according to the table below.

Report Type & Criteria	Product Documentation	Report Verification	Valuation
Material Ingredient Screening and Optimization Action Plan	Action Plan based on publicly available material inventory to at least 1,000ppm.	Prepared by the manufacturer and signed by company executive	½ product
Advanced Inventory & Assessment: Inventory to at least 0.01% by weight (100 ppm) and no Green Screen LT-1 hazards or GHS Category 1 hazards are present. Or Inventory to at least 0.01% by weight (100ppm) and at least 75% by weight of product is assessed using Green Screen. The remaining 25% by weight of product has been inventoried and the Green Screen assessment is publicly available.	Cradle to Cradle Certified or Material Health Certificate at Bronze level or higher. Declare labels designated as Red List Free or LBC Red List Free. Health Product Declaration that meet optimization and verification criteria. Living Product Challenge certified products that include a Red List Free or LBC Red List Free Declare label. Manufacturer Inventory that meet optimization and verification criteria.	Third-party verified	1 product
Material Ingredient Optimization: Inventory to at least 0.01% by weight (100 ppm) and at least 95% by weight of product is assessed using Green Screen. No BM-1 hazards are present. The remaining 5% not assessed has been inventoried and screened using Green Screen List Translator and no Green Screen LT-1 hazards are present.	Cradle to Cradle Certified or Material Health Certificate at Silver level or higher. Health Product Declaration that meet optimization and verification criteria. Living Product Challenge certified products that		1.5 products

	achieve Imperative 09: Transparent Material Health. Manufacturer Inventory that meet optimization and verification criteria.		
International Alternative Compliance Path: Available to projects located outside of the US	REACH Optimization: Material Inventory to 100ppm with no substances found on the Authorization List – Annex XIV, the Restriction list – Annex XVII and the SVHC candidate list. OR Global Green TAG PHD report.	REACH report prepared by the manufacturer, OR PHD Report verified by Global Green TAG	1 product

For credit achievement calculation, products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at twice their base contributing number of products, up to a maximum of 2 products.

Alma Verde Village and Spa » Luz Lagos (Portugal)

Hotel name & type: *f* Hotel name: Alma Verde Village and Spa (FIG. 2)

Type of hotel: spa and residential resort (residential and holiday destination).

- Type of business: large group (Elixir group) *f* Services offered: villa and tourist apartment rental, spa and wellness Centre, residential homes.
- Category: 5 star
- Staff number: about 20 and rising to meet needs. Building. Construction: commenced 2000, and continuing.
- Climatic zone: Mediterranean, southern Portugal.
- Size of the building: varies from– 1 bed apartments to 4 bed villas.
- Number of guest rooms: numerous

(FIG.2, Alma Verde Village)

Environmental aspects:

- Winners and finalists in 15th international awards for Energy Efficiency and Sustainability.

Architecture including the Royal Sustainability Award Tourism - Accommodation in 2007.

- Annual energy consumption per m^2 : not available
- Energy consumption per night sold: not available

The hotelier's approach

Hotelier's motivation, historical background, etc.….

In view of the importance of making real reductions in carbon emissions, it has always been the aim of this resort to approach the project from a standpoint of pro-active environmental responsibility in every aspect of our operation.

The most effective way of achieving this is by designing and building to the highest standards of energy efficiency and sustainability, and doing so enables us to provide a leading example of what is possible (FIG .3).

(FIG.3 sustainability and eco-building)

Increasing public awareness and concern over climate change and environmental issues also places Alma Verde in a visible and attractive position in terms of profile in the current market.

Levels of satisfaction regarding energy conservation measures in place, etc.

There is little more that could have been achieved with our building stock in energy and environmental terms, and the financial benefits of enormous reduced energy costs are appreciated throughout.

These benefits will of course increase as energy costs continue to rise.

Factors that helped in the process:

- Involvement of architect and design team with experience and knowledge of best energy efficiency and environmental practices.
- EU Thermie part-funding for the Cool house Project under the Fifth Framework for research and development as a demonstration project to develop a low energy alternative to air-conditioning.
- The strong motivation of the owners.

Description of energy conservation measures in place

Make a first assessment

Energy consumption monitoring: Consumption is monitored to assess the performance of the resort.

Involve your guests Information to guests: All guests are made aware of the environmentally-friendly methods used during construction, the lower energy costs to operate the hotel and the health benefits of using this construction system.

Involve your staff

Staff information and involvement: All staff are trained to understand the environmental philosophy of the resort in order to incorporate it into all aspects of their job.

Protect the building from the extreme temperature

Building materials: By manufacturing adobe (sundried clay) blocks on site, and building with this traditional sustainable materials, the thermal mass of the walls stores radiates warmth and maintains the internal relative humidity at comfortable levels. The energy savings from the used construction materials Alma Verde are calculated to be at least 15% lower than average.

Envelope insulation:

A flexible, low maintenance, external insulation system reduces heat gains and losses and eliminates cold bridging. The insulation extends into the roof by means of timber (FIG.4). Sandwich panels are laid over laminated timber beams. External doors and windows are made from sustainably sourced timber frames with high performance Low-E argon filled solar-control glazing units.

(FIG.4, external insulation system)

Bio-climatic principles:

Buildings are designed on passive solar principles to maximize heat gain from the sun in winter whilst remaining shaded in summer.

(Note: Local weather conditions: The very high humidity leads to unhealthy black mold and water condensation in many buildings.)

Improve equipment efficiency

- **Lighting and electricity**

Lighting efficiency: All lighting is low energy and LED. Streetlights are also low energy and were selected to avoid glare and light pollution.

Electricity use control:

In tourist apartments, all electrical systems are designed to have access control which shuts off electricity when the rooms are not occupied. All appliances are A rated.

Space conditioning, ventilation and domestic hot water:

Residential buildings alone are responsible for 30% of European energy use, the greatest part is being due to heating and cooling with energy peaks moving to the summer months in Portugal due to local air-conditioning.

Cooling system:

Through the Cool house project, Alma Verde has developed a virtually zero carbon, Cool house cooling system that brings fresh air into the building via underground tubes.
In summer the subsoil cools the air, and in the winter it is warmed.
In tourist apartments cooling is designed to be provided by geo thermally cooled fan coil units or a chilled slab, and a heat recovery system will operate the resort laundry.

Ventilation:

Building design ensures passive stack natural ventilation and permanent trickle ventilators enable continuous air displacement and avoid the need for mechanical ventilation.
This is provided in bathrooms to remove humidity at its source, and is operated by presence of detectors.

Water saving:

Hot water is partially supplied by solar water collectors backed up by 97% efficient modulating condensing gas boilers, where hot water return reduces heat waste and also saves water. Further water conservation measures include dual low flush WC’s, airflow water taps and showers in all bathrooms.

Integration of renewable energies

Space heating is done by controlled solar gains coupled with thermal mass, backed up by 97% efficient modulating condensing gas boilers driving a low temperature radiant skirting system in the smaller residential buildings when necessary.
In larger apartment and administrative buildings, space heating is done by biomass boilers or reverse cycle geothermal heat pumps which also provide cooling.
Fresh ventilated air is supplied in winter through the Cool house geothermal system which generally preheats incoming outside air to 13-14 degrees.
Hot water is supplied by solar water collectors with a high efficiency gas boiler backup.

Benefits for the hotel

Economic performance:

Energy savings:

The building method incurs approximately a 15% -20% extra cost over contemporary building techniques. However, the operating costs will be lower than with traditional methods.
“Using a specific loss comparison table, with variables adjusted to current building regulation requirements in the Algarve region, there is a 65% energy use reduction in the Cool house building. “
“There is little more that could have been achieved from our building materials in terms of energy savings or reducing our environmental impact, plus the financial benefits of bio-energy savings are appreciated throughout. These benefits will of course increase as energy costs continue to rise.”

Improved market visibility
Benefits include: potential for market differentiation/green marketing.

Healthier humidity level
The combination of Alma Verde’s unique adobe breathable wall construction and Cool house reduces internal humidity levels by up to 30% RH compared to outside levels, bringing these levels down into the 40 to 60% RH band is considered necessary for the health of occupants.

Improved control of temperature
One year of performance monitoring of the Cool house construction system showed that when external day-to-night summer temperature drops by 20ºC (from 38 to 18ºC), the internal temperature remains constant at about 26º C.

Environment

Lower environmental impact
Monitoring has shown that the cooling system generates only 810 kgCO2/ year. Independent engineers Faber Maunsell (London) have calculated that the same building was built according to local building regulations and cooled to an equivalent level with conventional air conditioning, it would have generated 15,200 kgCO2 / year, with a saving of 94% in CO2 emissions.

Alma Verde Building Specifications:
Prior to starting any construction, Alma Verde architects and engineers undertook a review of typical local building techniques and standards, identifying a number of common problems including inadequate insulation, poor ventilation, thermal bridging and lack of damp-proofing.
Alma Verde then developed a new building specification tailored to local climate conditions with the aim of addressing these shortcomings and delivering a comfortable year – round living environment at low energy cost.
In the western Algarve of Portugal, external temperature can fall 15-degree C or more from day to light.
The Alma Verde specifications use the basics principle of well- insulated thermal mass to completely stabilize the internal temperature over the 24- hour cycle.

The specification includes an external insulation envelope to inhibit heat gains and losses and to eliminate problems with thermal bridging.
The reinforced concrete structure of the building is then well insulated and available as thermal mass to help to stabilize the interior temperature.
This mass is dramatically augmented by the use of dense, sun –dried clay blocks, mortared and rendered with more finely granulated clay to from the inner walls as well as the inner scan of the outer walls.
The mass of the building itself, then acts as a storage heater in winter or source or radiant stored "cold" in summer.
The micro –porous adobe walls also help to regulate internal humidity, keeping it within comfortable, healthy levels.
In summer, the cool house comfort cooling system brings cooled air into the house throw underground tubes via a sub – floor plenum, helping to purge the thermal mass of accumulated heat.
Passive design strategies are also employed, including the use of overhangs in front of southerly patio door openings, to limit summer solar gains whilst allowing winter solar incidence.

Structural frame: -
Formed using reinforced concrete beams and columns founded on individual concrete pad foundations, designed to support normal loads and to resist additional seismic loads.
Outer walls are supported by a reinforced concrete ground beam or concrete sub –wall with 30 mm XPS is graphite –enhanced to prevent passed infestation from below.

Outer walls:
Formed using an outer leaf of 100 mm termoarcilla terracotta blocks and an inner leaf of 115mm high- density, adobe blocks, except for bathrooms and around door openings, which are also formed using termoarcilla blocks.
The outer leaf is constructed to allow vapor to transpire outwards.
The termoarcilla blocks slot together using a tongue and groove vertical joint, which is left without mortar to promote vapor permeability(FIG.5).

(FIG.5, outer wall construction)

Outer walls are externally insulated with 60mm XPS insulation and finished with a 5mm fiber-reinforced, vapor permeable thin coat render system, the textured final coat of which is flexible to prevent cracking and pre-colored to reduce the need for regular repainting.

Inner walls:
Formed using singles leaf 115mm or full width 240mm adobe block for thermal mass and finished with 15mm of special clay render and white matt vapor –permeable paint, except for

bathrooms and around door openings, where the inner walls are formed using 100mm termoarcilla terracotta blocks and finished with sand and cement render and acrylic matt paint, or with ceramic wall tiles to door frame height to a value of 12.5 euros /m excluding IVA.

Roof areas:

Pitched roofs are formed using timber sandwich panels incorporating 80mm XPS insulation and supported by laminated timber rafters (FIG.6).

A traditional style Portuguese barrel system tiles is installed on battens over an impermeable, waterproof Breathing membrane, ensuring good ventilation below the tiles and preventing rainwater penetration.

The underside of the sandwich panels forms pitched timber ceilings.

(FIG.6, roof is an impermeable waterproof)

Sandwich panels are finished to complement the natural wood finish of the external doors and windows.

Timber rafters are finished with clear varnish, giving a lighter tone than the roof panels.

The option exists to finish both rafters and sandwich panels in a matching lighter or darker tone.

Roof terraces and other flat areas use as well-insulated concrete deck inverted roof construction incorporating a combined external insulating and impermeable layer.

Roof terraces are covered with concrete promenade tiles seated on plastic mounts.

Windows, Doors, Shutters, Gallery access stairs and Balustrades

External doors and windows are of durable treated timber from sustainable sources. In addition to being thermally resistant the double-glazed tilt –and turn windows incorporate trickle vents for ventilation. solar-exposed south and west units incorporate solar control film to inhibit summer solar gains. All glass windows and doors incorporate low-emissivity glass and are laminated for additional security. Main front doors are in solid durable-timber with multi-point locking.

FIG.7, External doors and windows

All windows open inwards unless otherwise indicated on the plans (FIG.7).

External shutters of durable treated timber are fitted as per plans to solar-exposed south and/or west facing windows and/or doors to inhibit summer solar gains.

Internal doors are faced in natural timber veneer.

Matching timber architraves are fitted to the surrounds of all frames.

Gallery access stairs and balustrades are constructed in solid durable timber.

All timber is from sustainable sources.

Fitted Bedroom Furniture

(FIG.8, design of bedroom furniture)

Wardrobes are fitted in all bedrooms as per plans and are finished with full length-timber-faced doors to match the internal doors (FIG.8).
Each unit typically includes a fitted dressing table and there are a mirror and a lighting unit on top.

Kitchens

Floor and wall cabinet doors polylaminate-faced with 30mm solid granite worktops and granite splash-backs. The stainless steel sink incorporates a one block tap with shower spray head.

Kitchen Appliances

Appliances comprise a built-in 600mm electric oven unit with a gas hob grill with an externally vented extractor hood, a tall fridge/freezer or separate built-under fridge and freezer an integrated washer/dryer and an integrated dishwasher. Appliance which are visible are made of stainless steel(FIG.9)

Bathrooms Shower Rooms Cloakroom

Wash hand-basins are porcelain inset into or mounted over a vanity unit with cupboards under, or mounted on a pedestal, and in all cases with a mirror and lighting on top. A bidet is included in the master bathroom (FIG.10).
Bath and shower rooms have electrically heated towel rails.
Baths are of pressed steel or acrylic with tiled surround.
All baths and showers have thermostatic mixer units.
Shower rooms have shower trays with matching tile surround, tempered glass shower screens and other fittings as per bathrooms unless otherwise indicated in the plans.
Cloakrooms have toilet, pedestal washbasin and towel rail.
Bathroom layouts are as pear detailed construction drawings

(Fig .10 design of bathroom)

Domestic Hot water and Central heating system

Domestic hot water is heated by an array of two solar collectors located on a south-facing roof (FIG .11).
Heated water is stored in a 300-liter hot water cylinder, with back –up water heating provided by an electric immersion coil.
Under – floor heating is standard in all rooms, with the circulating water being heated by an electrically powered air- to water heat pump controlled by a single set or timing and temperature controls for the in villa.

(Fig.11, solar collectors)

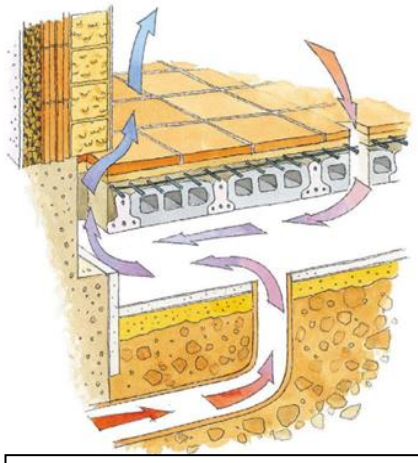
(Fig9, design and kitchen appliances)

The heat pump and temperature controls will also operate on reverse cycle to provide some summer cooling.
The heat pump provides a 3 to 5 times efficiency improvement over direct electric coil water heating.
Options are available at additional cost to include

- Hot water return circuit, the circulation pump being switch- controlled at each bathroom to provide virtually instant hot water with no water wastage.
- Multiple under-floor central heating zones each controlled by a zone – specific two – way thermostat.
- Relative humidity sensor and due point tracking to prevent floor condensation during reverse cycle for summer cooling.

Cool House Cooling and Ventilation System

The standard includes the signature cool house energy-efficient system for ventilating the house and providing comfort to the ground floor daytime living areas.
Fresh air enters these areas through vents situated at skirting level (FIG.12).
In the summer, the system provides cooled fresh air for programmed time periods, for example in the afternoon and early morning helping to purge eat from the thermal mass of the structure.
The system employs underground PVC tubes of 160mm in diameter to deliver air throw ground-level vents via a sub-floor plenum or void. Tubes are buried to a depth of between 1.5m and 2m and for a total length in excess of 70 cm. Fresh air is driven through the tubes using a variable speed 170w air-handling unit housed in a chamber against an exterior wall. In summer the unit is typically set to operate for 3 hours in 8, or 4 hours in 12, as operating the system continuously makes it ineffective.



(FIG.12 under floor ventilation)

Average consumption is accordingly approximately 60W/h.
The system has been rated to achieve 2.5W/h of comfort cooling and anticipates an average reduction in internal summer air temperature of 3 C, whilst achieving peak reductions of up to 12 C.
When in operation at full speed the system forces approximately 6 x changes of air per hour in the winter, the system enables fresh air to be brought into the house and in cold conditions will raise its temperature rather than lowering it.
The system ensures that the internal air stays fresh even with the windows closed.
It helps to regulate humidity and eliminate any possibility of mold formation.

Lighting

Wall lighting in generally is used in preference to ceiling lighting

With ceramic half- moon shades painted white to match the walls.

Half – moon shades act as up – lighters internally and down- lighters externally.

Spotlights are fitted into some flat ceilings and suspended lighting provided in some kitchen and dining area situations as per detailed construction drawing.

Low-energy LED bulbs are fitted as standard (FIG.13).

(FIG.13 lighting system)

OTHER SERVISES

Ample electric sockets are included.

An external socket is provided near the pool area.

Ample telephone and television aerial sockets are included.

Villas are pre-wired for an intruder detection system.

(FIG.14, terrace path around the house)

Terraces Paths Drives

The area 1m wide all around the house as well as the pool terrace and other paved areas are covered with terracotta color ceramic tiles over a reinforced concrete sub-base and a screed laid to falls to provide effective storm-water drainage. Terraces are per detailed construction drawings. Drive ways are formed using fully permeable, gravel-filled recycled plastic honeycomb.

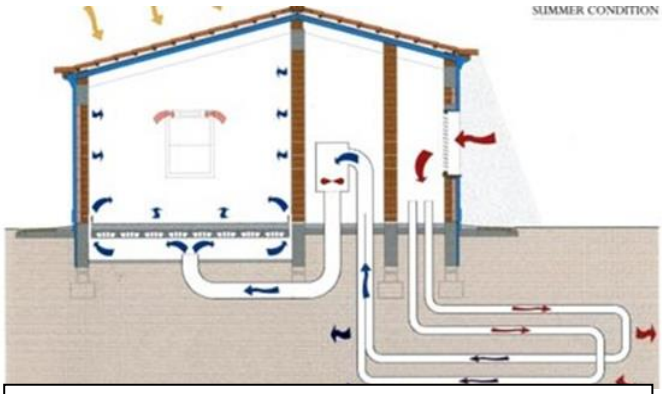
Mesh laid over a geo-textile on a compressed granular bed (FIG.14).

Irrigation

Pop-up sprinklers are used for lawn areas rockeries and flower beds, and drip tube for hedges and shelter belts: specimen trees and shrubs are irrigated individually for accurate and waste-free application automatic valves are located in each irrigation zone, allowing multi-start time and zone duration control for night watering (FIG.15).

(FIG.15 irrigation specimen trees and shrubs)

Heating and cooling



(FIG.16, Heating and cooling system)

Alternative or passive heating and cooling refers to geothermal systems which harness energy from the earth and use it directly for heating or cooling.

These are not to be confused with ground source heat pumps, which also use energy from the ground but transfer the heating or cooling to the building via a heat pump.

Geothermal technology can be split into two types – water systems and air systems.

With water systems, water is pumped through underground pipework in a closed circuit and then it is connected to a heat exchanger above ground (FIG.16).

The heating or cooling energy is then transferred via this heat exchanger to the particular heating or cooling system within the building.

This could be an air ventilation system or a chilled water/heating system. This is normally used in conjunction with a standard heating or cooling system as back up.

Air systems are more popular as they are simpler and therefore cheaper to install. Fresh air passes through underground ductwork using a filter/fan system and is then heated or cooled by the earth.

This treated fresh air then passes into the building to provide some heating or cooling as well as ventilation.

Geothermal air systems have already been tried and tested here in the Algarve. The Alma Verde development near Lagos has implemented this technology in all its villas with great success, so much so that mechanical cooling (air conditioning) is not installed.

This not only saves on installation costs but also significantly reduces energy consumption and thus running costs (the energy consumed by the ventilation fan is a fraction of that consumed by a compressor within an air conditioning unit).

At Alma Verde, in each house, a small plant room houses the ventilation plant. This consists of an inlet fresh air grille connected to a fan which in turn connects to the underground ductwork system. Air is drawn through the underground ductwork where it is cooled and then introduced into rooms within the house via low level outlets. Attenuators ensure that the system is very quiet.

As well as introducing cool fresh air into the house, the system also cools the building structure. Because the walls have thermal mass, they have the ability of retaining this cool energy which further helps to keep the temperature down.

Geothermal systems can also be used for heating, although it is less in the Algarve. The underground temperature is fairly constant at about 2 meters down (between 10 to 15 degrees C), and thus on cold days and nights, some heat can still be recovered; however, this is best

used in conjunction with standard heating systems (as a way of preheating fresh air as it enters the building).

The important thing to remember with this type of technology is that although it will provide a certain degree of heating and cooling, it will not necessarily be enough to satisfy the full heating or cooling demands of the building. It is therefore ideal in certain temperature conditions but will sometimes require the back up of a standard heating or cooling system.

As with all renewable energy systems, the construction of the building is also very important. If a building has good thermal mass and good insulation, then in many cases geothermal energy will be adequate with normal systems, it is only required as back up during more extreme weather conditions.

Exceptional Architecture:

Alma Verde's unique building specification offers the following top ten major benefits when compared with other developments.

- High levels of thermal mass and insulation improve thermal comfort and reduce energy costs.
- Adobe (sun dried clay) inner walls help to regulate humidity and reduce the risk of condensation.
- Solid interior walls provide superior sound insulation.
- Vapor-permeable walls and roofs assist with humidity control and contribute to health protection.
- External insulation eliminates risk of cold bridging across concrete frame.
- External render system does not crack and, being self-colored, does not require frequent repainting.
- Impermeable membranes and damp courses provide superior protection from rain and damp incursion.
- High-quality timber laminated double-glazed units assist with thermal and sound insulation, security, ventilation and control of solar gains.
- Cool house system provides summer cooling at low energy cost, as well as controlled fresh air in winter.
- Under floor heating powered by an air/water heat exchanger minimizes winter heating cost and offers some reverse cycle summer cooling; solar thermal panels provide domestic water heating virtually cost free.

In addition, superior quality fittings and finishes enhance the value of your investment, including:

- Custom designed timber balustrades.
- Beech finish interior doors and wardrobe units.
- High-quality bathroom fittings.
- Granite kitchen worktops and splash backs.
- Zanussi kitchen appliances.
- Pebble pools.

Reulsts:

1. Green hotels preserve the environment and natural resources.
2. Green hotels reduce greenhouse gas emissions and carbon dioxide.
3. Green hotels help attract tourists and revive the economy.
4. Green hotels reduce hotel payments as a result of reduced consumption of fossil energy and water consumption, thus generating financial gains for green hotel owners.

Recommendations:

1. Spreading knowledge awareness among designers and hotel owners about the importance of green hotels to preserve the environment and achieve financial gains for hotel owners.
2. Attention to sustainability standards when constructing modern hotels.
3. The interior designer must use natural materials that suit the environment of the place and can be recycled.
4. The interior designer realized the importance of using solar energy in interior design and furniture.

Reference:

1. Sarah Alexander (September 2002), GREEN HOTELS: Opportunities and Resources for Success.
2. Abdel-Maksoud, A.; Kamel, H.; Elbanna, S. Investigating relationships between stakeholders' pressure, eco-control systems and hotel performance. Int. J. Hosp. Manage. 2016, 59, 95–104.
3. Bender, A. Survey: Two-Thirds of Travelers Want Green Hotels. Here's How to Book Them. Available online: https://www.forbes.com/sites/andrewbender/2013/04/22/survey-two-thirds-of-travelerswant-green-hotels-heres-how-to-book-them/?sh=120cf5eb2e2f (accessed on 5 November 2020).
4. Erdogan, N.; Baris, E. Environmental protection programs and conservation practices of hotels in Ankara, Turkey. Tour. Manag. 2007, 28, 604–614.
5. Jones, P.; Hillier, D.; Comfort, D. Sustainability in the hospitality industry. Int. J. Contemp. Hosp. Manag. 2016, 28, 36–67.
6. Shen, L.; Qian, J.; Chen, S.C. Effective communication strategies of sustainable hospitality: A qualitative exploration. Sustainability 2020, 12, 6920
7. Wolfe, K.L.; Shanklin, C.W. Environmental practices and management concerns of conference center administrators. J. Hosp. Tour. Res. 2001, 25, 209–216.
8. Kim, S.-H.; Lee, K.; Fairhurst, A. The review of "green" research in hospitality, 2000–2014. Int. J. Contemp. Hosp. Manag. 2017, p, 236.
9. Rahman, I.; Reynolds, D.; Svaren, S. How "green" are North American hotels? An exploration of low-cost adoption practices. Int. J. Hosp. Manag. 2012, p, 721.
10. Myung, E.; Mc Claren, A.; Li, L. Environmentally related research in scholarly hospitality journals. Int. J. Hosp. Manag. 2012, 31, 1264–1275.

11. Green Hotel Association. What Are Green Hotels? Available online: ttp://greenhotels.com/index.php (accessed on 25 September 2020).
12. https://www.usgbc.org/sites/default/files/2020-04/2019-LEED-Proposals_USGBC-Responses_200403.pdf
13. https://www.usgbc.org/credits/new-construction-core-and-shell-schools-new-construction-retail-new-construction-data-26?return=/credits/Hospitality%20-%20New%20Construction/v4.1
14. https://www.usgbc.org/credits/new-construction-core-and-shell-schools-new-construction-retail-new-construction-data-26?return=/credits/New%20Construction/v4.1/Material%20&%20resources
15. https://www.usgbc.org/credits/new-construction-core-and-shell-schools-new-construction-retail-new-construction-data-27?return=/credits/New%20Construction/v4.1/Material%20&%20resources