Volume 9, Issue 7, July – 2024 International Journal of Innovative Science and Research Technology
ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24JUL808

Optimising the Energy and Resources of Hotel Buildings in Cameroon from a Zero-Carbon Perspective

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Abstract:- This article explores the potential for Cameroonian hotel buildings to achieve optimal energy and resource use, contributing to a zero-carbon future. It examines the opportunities that lie in high-performing hotels to achieve the country's ambitious environmental objectives such as reducing its greenhouse gas emissions by 32% by 2035 compared with the reference scenario under the Paris Agreement. Then, the article delves into the existing landscape of green building labels and certifications while focusing on those related on hotels specifically like the Green Key. It acknowledges the various hotels categories present in the country and how their specific characteristics influence resource demands. Additionally, it presents the regulations governing the construction and conversion of hotel establishments. Furthermore, the article discusses strategies for optimising the performance of building resources within the tropical context. These involve improving the insulation of the building envelope, the efficiency of systems and the use of renewable energy sources. The article highlights the importance of the prescriptive approach for assessing and the energy performance approach for optimising building performance, using the accessible EDGE energy simulation software. Those approaches are defined in the Ivorian Inter-ministerial Order No. 134/MPEER/MCLU of 18 November 2020, given that Cameroon and Côte d'Ivoire have some similar climate zones. To achieve the EDGE Zero Carbon level, it is essential to demonstrate minimum savings of 40% of energy, 20% of water and 20% of grey energy in materials, and 100% of energy-related emissions neutralised either by renewable energies or by carbon offsets. Finally, the concept of green financing is introduced, examining its potential to facilitate the transition towards sustainable hotel development.

Keywords:- *Hotel Building, Energy Renovation, Zero-Carbon Approach, EDGE Energy Simulation, Cameroon.*

I. INTRODUCTION

Growing needs, environmental and climate change challenges, a growing world population and even the high price of water and energy mean that particular attention must be paid to resource efficiency [1]. Efficient and sustainable use of resources is necessary for environmental protection and economic growth [1]. With this in mind, it is worthwhile targeting the most energy-intensive sectors and implementing solutions to maximise water and energy efficiency. Among the most energy-intensive sectors, the building industry tops the list, along with the transport sector [2]. Hotel buildings in particular are major consumers of energy and water due to their 24-hour operation, intensive use of equipment and the services offered to guests. According to a study by the Sustainable Hospitality Alliance [3], the hotel industry accounts for more than 1% of global greenhouse gas emissions, and in some places tourism consumes eight times more water per person than the local population. In recent years, voices have been raised to propose a different kind of tourism, responsible tourism, which is also proving to be a profitable business insofar as profit margins are increased thanks to energy savings, value is increased through certification and long-term energy supply is guaranteed [3]. In response, the tourism industry is making commitments such as the Glasgow Declaration, which aims to mobilise the tourism sector to reduce its greenhouse gas emissions and adapt to the impacts of climate change. It has over 450 signatories, including Cameroon [1].

Today, as well as designing more environmentally-friendly hotels, it is important to minimise the carbon footprint of existing ones. However, if the aim is to meet global targets for the climate impact of buildings, stronger measures need to be taken. It is with this in mind that the Nearly Zero Energy Building initiative has been launched. Its main aim is to meet the European Union's objectives in terms of energy efficiency by offering buildings with very low energy consumption [4].

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24JUL808

The aim of this article is to highlight the opportunity that high energy performance hotel buildings represent for Cameroon and to identify strategies for renovating these buildings.in; examples of the type styles are provided throughout this document and are identified in italic type, within parentheses, following the example. Some components, such as multi-leveled equations, graphics, and tables are not prescribed, although the various table text styles are provided. The formatter will need to create these components, incorporating the applicable criteria that follow.

II. THE OPPORTUNITIES OF HIGH ENERGY AND ENVIRONMENTAL PERFORMANCE HOTEL BUILDINGS IN CAMEROON

Global awareness of the crisis into which human action has plunged the Earth is triggering urgent, different but concordant actions at global, regional and local levels, aimed at controlling global warming. Cameroon has signed and ratified several international conventions and agreements relating to the climate, such as the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol. Cameroon also drew up and submitted its Nationally Determined Contribution (NDC) in 2015, as part of the Paris Climate Agreement. Cameroon's NDC aims to reduce its greenhouse gas emissions by 32% by 2035 compared with the reference scenario, subject to financial, technical and technological support from international partners [5].

At continental level, in 2013 the African Union adopted Agenda 2063, a strategic blueprint for Africa's future. It aims to accelerate Africa's integration process, promote economic growth and improve the quality of life of Africans. Agenda 2063 is divided into seven aspirations, one of which focuses on environmental sustainability and climate resilience [6].

At national level, through its National Development Strategy 2020-2030, Cameroon plans to strengthen actions in the area of sustainable management of natural resources (soil, flora, fauna, water) and take appropriate measures to adapt to and mitigate the effects of climate change [7].

Furthermore, projections are clear: the world's population is set to grow. It is expected to reach 8.5 billion by 2030, 9.7 billion by 2050 and 11.2 billion by 2100 [8]. This increase is accompanied by pressure on resources. According to estimates based on current consumption practices, the planet will face a 40% imbalance between water supply and demand by 2030 [9]. Cameroon's population is increasing at a rate of 2.59%. Cameroon's current population of around 26.55 million is expected to rise to 50 million by 2050 and 89.62 million by 2099 [11]. Only 63.5% of the population had access to electricity in 2021, and growth in demand is estimated at 7.5%/year [9]. In addition, new electricity tariffs have been in force in Cameroon since 1 January 2023. According to civil society, this decision by the regulator will increase the price of electricity by more than 30% [12].

These findings mean that particular attention needs to be paid to resource efficiency, and it is becoming interesting to target the most energy-intensive sectors. In 2019, emissions from the operation of buildings reached their highest level, at 9.95 Gt CO2. This sector accounts for 38% of total global energy-related CO2 emissions if emissions from the building construction sector are included. The building sector needs to halve its direct CO2 emissions by 2030 to achieve a net carbon-free building stock by 2050 [2]. The hotel sector is not to be outdone, accounting for more than 1% of global greenhouse gas emissions [3]. Reducing the energy consumption of buildings, and specifically hotels, is possible and offers economic, environmental and social benefits. Among other things, it helps to save on costs, improve the competitiveness and attractiveness of establishments, reduce greenhouse gas emissions, contribute to the energy transition, and offer greater comfort and a better quality of service to customers. To achieve these objectives, there are solutions for optimising energy consumption from an architectural and engineering point of view [3].

III. GREEN LABELS AND CERTIFICATIONS FOR BUILDINGS

Table 1 Some Green Labels and Certifications in the Building Sector in General [13]

Labels	Management body	Type	Field of ntervention
Energy Star	U.S. EPA et U.S. DOE	Certification of governments using a benchmarking method	Energy and water consumption of buildings
Leadership in Energy and Environmental Design (LEED)	U.S. Green Building Council	Green building assessment and certification system through independent third-party verification: New buildings ; Existing buildings; Operation and maintenance ; Commercial Interiors; Core and shell ; Schools ; Retail; Health care ; Homes ; Neighbourhoods.	Sustainable Sites; Water Efficiency; Energy and Atmosphere; Materials and Resources; Indoor Environmental Quality; Locations and Linkages; Awareness and Education; Design Innovation; Regional Priority through a set of prerequisites and credits

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24JUL808

Green Globes	Green Building Initiative U.S. BOMA Canada	Green building guidance and assessment programme for : existing buildings new buildings	Energy; Indoor environment; Site; Emissions; Project/environmental management; Water resources
WELL Building Standard	International WELL Building Institute™ (IWBI)	Performance-based standards and certification programme for : New and existing buildings New and existing interiors Core and shell, Retail Education, Facilities Restaurants, Kitchen Kitchen Multi-family Residential	Measures the characteristics of buildings that have an impact on the health of occupants by examining seven factors: air, water, food, light, physical fitness, comfort and spirit.
BREEAM (UK, EU, EFTA états membre, EU candidates, Golfe Persique)	BRE Global	The certification system is a multi-level process with pre-assessment, guidance by a third-party consultant through an assessment body for : New buildings Local authorities Buildings in use Ecological homes	The assessment uses recognised measures of performance, which are compared against established benchmarks in the following areas Energy and water use; Internal environment (health and well-being); Pollution; Transport; Materials; Waste; Ecology and management processes
EDGE	International Finance Corporation (IFC), a member of the World Bank Group	A universal standard and certification system for all types of buildings	The areas of assessment are as follows energy water Materials

There are also labels specific to the hotel sector, including the following:

- La Clef Verte or Green Key: This is an international tourism ecolabel awarded to eco-responsible accommodation and tourist establishments. It recognises the efforts made by these establishments to reduce their impact on the environment and promote sustainable practices [14].
- Green Globe 21 certification: The label assesses the operations and practices of organisations in the tourism sector in various areas, including the management of energy, water, waste, transport, biodiversity, local communities and employee well-being [15].
- Chouette Nature: French label designed to encourage and recognise the actions of local authorities in favour of biodiversity and environmental conservation [16].

IV. HOTEL CATEGORIES IN CAMEROON

Table 2 Default Characteristics of Hotel Categories Located in Yaoundé [17]

Hotel Category	**1-Star**	**2-Star**	**3-Star**	**4-Star**	**5-Star**
Floor area (m²)	4 000	4 400	4 800	7 600	8 400
Final energy consumption (kWh/month)	64 200	74 030	79 440	135 407	145 740
Final water consumption (m3/month)	2 245	2 345	1 707	2 715	2 934
Final operating CO2 emissions (tCO2/month)	22,61	26.06	27.98	47.69	51.32
Final embodied carbon (Kg CO2e/m²)	421	417	413	395	390
Final cost of water and energy services (XAF/month)	7 147 934	8 112 504	8 274 170	13 999 852	15 074 575

Table 3 Summary of the Number of Hotels Recommended by Region at 22 December 2022 [18]

REGIONS	**CAPACITY**			**CATEGORY**				**TOTAL NUMBER OF HOTELS**
	ROOM	**SUITE**	**APPARTMENT**	**5***	**4***	**3***	**2***	
CENTRE	5920	420	178	01	10	33	73	117
LITTORAL	7147	304	151	01	10	35	95	142
WEST	2609	142	67	01	01	11	53	66
NORTH -WEST	1013	24	05	00	00	08	14	22

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24JUL808

SOUTH - WEST	1111	73	72	01	02	08	18	29
ADAMAOUA	541	10	06	00	00	04	09	13
NOTH	663	16	05	00	01	05	04	10
FAR NORTH	914	02	10	00	00	04	04	08
EAST	603	43	00	00	00	02	07	09
SOUTH	1481	78	79	00	03	14	20	37
TOTAL	22 002	1112	573	04	27	123	297	472

Table 4 Summary of the Number of Hotels Classified By Region and by Category as of 25 November 2022 [18]

REGIONS	CAPACITY			CATEGORY						TOTAL NUMBER OF HOTELS
	ROOM	SUITE	APPARTMENT	5*	4*	3*	2*	1*	NC	
CENTRE	9367	478	209	01	10	33	73	230	22	369
LITTORAL	8435	310	198	01	10	35	95	135	01	277
WEST	3903	192	70	01	01	11	53	136	02	204
NORTH -WEST	1703	77	11	00	00	08	14	48	00	70
SOUTH - WEST	1411	88	85	01	02	08	18	31	00	60
ADAMAOUA	965	17	00	00	00	04	09	31	01	45
NOTH	1273	21	13	00	01	05	04	34	06	53
FAR NORTH	1644	13	10	00	00	04	04	75	02	88
EAST	967	47	00	00	00	02	07	37	01	47
SOUTH	2124	76	73	00	03	14	20	73	00	110
TOTAL	31 792	1319	669	04	27	123	297	830	35	1286

Looking at the three-, four- and five-star categories, we see that although there are more three-star hotels, four-star hotels consume twice as much energy.

V. CONSTRUCTION OR CONVERSION OF A HOTEL ESTABLISHMENT IN CAMEROON

Articles 10 and 11 of Decree No. 2022/5075/PM of 04 July 2022 laying down the modalities for the application of Law No. 2016/006 of 18 April 2016 governing tourism and leisure activities in Cameroon provide information on the procedure to be followed for the construction or conversion of a tourism establishment, in particular a hotel establishment [19].

Article 10 stipulates that the application for a building permit for the construction of a tourism establishment or leisure infrastructure, made up of sixteen (16) copies, including an original and a digital copy, shall be sent to the Minister in charge of tourism and leisure. It must include the following documents

- A stamped application, the form for which is provided by the Ministry responsible for tourism and leisure activities;
- A certified copy of a valid National Identity Card or residence permit for individuals;
- A certified copy of the articles of association for legal entities;
- A certificate of non-bankruptcy less than three (3) months old;
- A copy of registration with the Trade and Personal Property Credit Register;
- A valid no-fee certificate;
- A duly registered certificate of ownership or lease agreement;
- A valid planning certificate;
- Valid planning permission;
- A complete set of construction plans signed by an architect registered with the National Order of Architects of Cameroon (ground plans, location plans, distribution plans, facade plans, roof plans, reinforced concrete plans, septic tank plans and cross-sections);
- A detailed description and estimate of the work, signed by an architect registered with the National Order of Architects of Cameroon;
- A calculation note signed by a civil engineer registered with the "Ordre Nationale des Ingénieurs de Génie Civil du Cameroun" for at-grade buildings;
- A sounding or auscultation report drawn up by a geotechnical study firm or laboratory approved by the Ministry in charge of public works for infrastructures of three storeys or more;
- A certificate of environmental and social compliance for projects in the three-, four- or five-star categories;
- A receipt certifying payment of the fees provided for in Article 11 of Law 2016/006 of 18 April 2016 governing tourism and leisure activities in Cameroon.

In the case of Article 11, it stipulates that the application for authorisation to convert or extend a tourist establishment or leisure facility must include, in addition to the documents referred to in Article 10, a certified copy of the building permit.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24JUL808

VI. ENERGY EFFICIENCY REQUIREMENTS

The purpose of Ivorian Inter-ministerial Order No. 134/MPEER/MCLU of 18 November 2020 is to define the energy efficiency requirements for buildings and set out the verification procedures for determining compliance with the energy efficiency requirements for buildings [20]. Given that Cameroon and Côte d'Ivoire have some similar climate zones, this standard can be applied to buildings in certain areas of Cameroon. Indeed, the equatorial tropical climate of Yaoundé is also found in Côte d'Ivoire.

This decree proposes a set of approaches for assessing a building's compliance with energy efficiency requirements:

- The prescriptive approach sets minimum or maximum technical specifications for the building envelope or mechanical and electrical systems.
- The performance method, which requires energy simulation software, involves using a reference building whose characteristics comply with the prescriptive approach to establish the annual energy consumption to be met. The desired characteristics are then established (roof, external walls, windows, opening/wall ratio, solar protection, lighting, etc.) and these must provide an equal consumption to be respected.

Numerous dynamic simulation tools are available on the market, and are more or less expensive, depending on their interface and completeness. They include DOE-2.1E, eQUEST, ENERGYPLUS, OPENSTUDIO, SIMERGY, RADIANCE, DAYSIM and ECOTECT.

Dynamic simulation, although credible in terms of results, is difficult to use by the average building professional and lacks transparency in terms of auditing the calculation process. Rather than offering a perfect or predetermined scenario, EDGE software provides users with a set of best practices that they can study to identify an optimal design solution. In addition, it differs from the others in the following respects [17]:

- Financial calculator: no other certification scheme has free software to calculate the costs of going green;
- Quantitative approach: EDGE uses expected performance for a single measurable approach;
- One-stop shopping: EDGE software can be used to run resource efficiency simulations and also to manage the entire certification process. For a building to achieve EDGE Zero Carbon certification, it must demonstrate savings of 40% in energy, 20% in water, 20% in embodied energy in materials and 100% in energy-related emissions offset either by renewable energy or by carbon offsets;
- Locality-specific: EDGE has data on local climate and lifestyle for more accurate results;
- Green building for all: Fast and affordable, EDGE makes green certification accessible to everyone.

VII. OPTIMISING THE PERFORMANCE OF BUILDING RESOURCES IN CAMEROON

The stages in an energy renovation are [21]:

- Defining the project: We need to carry out a technical and architectural assessment of the building. This will highlight the building's potential and identify the most appropriate areas for investment, as well as any areas to watch out for and possible pathologies. If any problems are identified, they must be dealt with. The energy section of the technical diagnosis, often referred to as the 'energy audit', enables you to assess the amount of energy needed to heat, light and ventilate the building, and to identify the most appropriate energy improvement solutions.
- Organising the works: You need to apply for the necessary permits (prior declaration or planning permission, etc.) before starting work. You will also need to plan the works to determine the key moments and points to watch out for. For example, particular attention will need to be paid to managing the junctions between the various lots, and all the work will need to be well coordinated with each other.
- After the work: Successful energy renovation does not stop when the work is finished. Instructions for use and maintenance contracts must be provided.

In a building, the sources of resource consumption can be:

- Operational, i.e. during use of the building, for day-to-day activities;
- Managerial, i.e. planning energy use, monitoring consumption and ensuring that installations are fault-free;
- At the level of the building itself, i.e. its envelope or systems.

Optimisation involves raising staff and customer awareness at the operational and management levels, and implementing various strategies at the building level. The aim of optimising a building's performance is always the same:

- Reducing heat gain
- Efficient equipment and systems
- Integration of renewable energy

These strategies can be adopted during energy renovation work [22]:

A. Improving the Building Envelope

➢ *Roofing*

- Painting external roofs with light coloured finishes: Roofs painted with finishes with a low solar absorption coefficient make a significant contribution to reducing solar gains. Light colours normally reflect solar radiation better, but the normal perception of light and darkness should not be allowed to influence this. Since the human eye can only see the 'visible' component of the radiation, the most appropriate material should be assessed based on the solar absorption coefficients supplied by the manufacturers and obtained through experimental tests (different materials or pigments may have the same colour but a different solar absorption coefficient).

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24JUL808

- External insulation with insulation under tiles or with a ventilated roof: Insulating the roof from the outside reduces heat gain/loss through transmission and improves thermal comfort inside. Where possible, the application of insulation material should be combined with the use of a reflective layer. The action requires restoration work from the outside and the removal of tiles or roof coverings, which are normally replaced. Therefore a modernisation action is justified if the building is undergoing major renovation. In the case of external work, the cost of scaffolding and the measures required to ensure the safety of workers must be taken into account.
- Attic floor insulation: If the attic is not used at all, the most cost-effective solution is simply to place low-density insulation in rolls (e.g. mineral wool or glass fibre) directly on the floor. Obviously, the greater the thickness, the better the thermal insulation. If the attic is used occasionally and the occupants have to walk on the floor or place objects on it, it is advisable to use high-density insulation. In some cases, a surface finish (floor covering) suitable for walking may be necessary.

➢ *Walls*
- Paint exterior walls with a light-coloured finish.
- Reducing the U-value by applying a layer of insulating material: The external thermal insulation system (ETICS) is an optimal solution for energy-efficient renovation of the external walls of existing buildings. ETICS is a system applied from the outside of the wall, generally comprising (from the inside to the outside) a levelling compound, an adhesive, a levelling mortar, an insulating panel, an alkali-resistant reinforcing grid, a primer and a finishing coat, as well as sealants and accessory materials for application. The operation can be carried out relatively quickly and entirely from the outside, with very little inconvenience to users. It is also possible to apply external insulation using local materials (e.g. natural insulation materials, external finish with wood leaves).
- Thermal insulation with ventilated facade: Using this system to renovate existing buildings requires careful design, not only in terms of energy efficiency, but also because of static requirements; specialist, experienced companies are also needed for installation. A maintenance programme must be planned.
- Shading walls: Using vegetation to shade facades or windows is a natural solution that can help increase the building's sustainability. The aim is to provide an independent green structure that can be installed next to or at some distance from the walls to be protected. The installation of a vegetation system for shading purposes requires careful design of the system, a thorough understanding of the climatic conditions and the choice of the most appropriate type of vegetation, compatible with the climate and orientation.

➢ *Windows*
- Installation of solar protection systems: The main effects of external shading systems are to control incoming solar radiation and to control natural lighting, avoiding glare effects. The design of external shading devices must take several factors into account, namely: the orientation of the façade; shading from other buildings; the technical and architectural characteristics of the façade; any architectural constraints and the issues that need to be addressed when designing these systems do not only concern energy (an energy simulation is however recommended), but should also include structural aspects (how to attach the systems to the façade).
- Application of solar control films: The practical effects of this measure, which is cost-effective if the windows are in good condition, are that it reduces solar loads and energy costs for cooling. Some solar control films are designed to be installed outdoors (in which case scaffolding may be required), while others can be installed indoors.
- Shading by vegetation.

B. HVAC Improvements

➢ *Reducing Internal Operating Costs For Lighting*

The reasons why lighting costs are normally high can be summarised as follows: spaces are lit even when they are not needed; areas are lit inappropriately; natural lighting is not used properly; inefficient lighting equipment is used and poor maintenance of lighting fixtures. Some of the renovation measures that can be taken include:
- High-efficiency space lighting;
- Lowering lighting to an appropriate level in corridors, e.g. 100 lux;
- Maintaining lighting at 300 lux along windows;
- Adding presence detector control.

➢ *Improving The Performance Of Cooling Systems*
- Thermal insulation of pipes and air ducts;
- Installation of high-efficiency pumps: The energy performance of distribution circuits can be improved by replacing existing pumps with devices that consume less electricity. Controlling the speed of an electric motor using a VFD (Variable Frequency Drive) is the most effective way of adjusting the energy performance of pumps that have to operate at variable speeds.
- Installation of VMF technology: This is a multifunctional concept for total HVAC that simultaneously provides cooling, heating, domestic hot water and 100% fresh air with a single external unit (monobloc) [23].
- Installation of ceiling fans.

➢ *Improving Air Treatment And Ventilation Performance*
- Installation of heat recovery systems;
- Pre-cooling by evaporation of exhaust air.

➢ *Improving The Performance Of Control Systems*
- Installation of energy meters: For the end user, being aware of his or her individual energy consumption (and having to pay for the energy actually consumed) is a strong incentive to pay more attention to energy consumption;
- Installation of timers.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24JUL808

➢ *Visual and Acoustic Impact of Outdoor HVAC Equipment*

- Outdoor condensers/compressors in split systems can be large cubic units that can be noisy and difficult to hide. To mitigate the visual impact of these units, it is important to consider an appropriate location. Rear yards that are not visible from a public thoroughfare are the preferred location, side yards are another possible location, but they often require screening. Rear yards that are not visible from a public thoroughfare are the preferred location, side yards are another possible location, but they often require screening. Front yards and walls are the least recommended options. Rooftop mechanical equipment that is not visible from a public thoroughfare is often an acceptable option.

C. Improving domestic hot water systems

- Check that the water temperature is not higher than necessary;
- Check that it is possible to switch off all the pumps at night or when the system is not in use;
- Replace the heat generator with a more efficient one (e.g. a condensing boiler or heat pump);
- Check the thermal insulation of the distribution pipes;
- Check whether it is possible to install a solar thermal system.

D. Operational and managerial improvements

- Reduce operating times for HVAC systems;
- Cleaning and replacing filters;
- Provide an instruction manual for users.

E. Integration of Renewable Energy

- Photovoltaic solar energy: The photovoltaic effect consists of the transformation of electromagnetic radiation into electricity (direct current) by so-called photovoltaic cells, made of semi-conductor materials.
- Solar thermal energy: Solar thermal systems convert solar radiation directly into heat. Their use is compatible with all applications requiring thermal energy at a relatively low temperature, such as hot water production and air conditioning.
- Wind power: Small wind turbines can be installed on a roof, but great care must be taken to avoid any vibrations being transmitted to the structure of the building supporting them. Vibrations can cause fatigue and noise.

VIII. GREEN FINANCING

Financial institutions play a leading role in supporting the transition to a low-carbon economy by investing in green building projects, technologies and consumer loans. Lenders can capitalise on emerging markets with vast potential while generating attractive returns through better asset risk profiles [24].

For example, the International Finance Corporation, a member of the World Bank Group, provides investment and advice to help financial institutions launch a range of competitive products such as the following [24]:

- Green Construction Finance - reduced risk weighting for financing resource efficient property projects.
- Green Mortgages - estimated lower utility bills for larger mortgages that cover the cost of green technologies.
- Green Bonds - a fixed income financial instrument with securitization of green property loans as collateral.
- Home Improvement Loans - conventional or better-than-market loans for the renovation of green homes.

IX. CONCLUSION

Ultimately, optimising energy and resources in hotel buildings is essential if Cameroon is to achieve its environmental goals. The strategies described in this article can help to significantly reduce greenhouse gas emissions from the hotel sector and promote sustainable development in Cameroon.

The 'Africa Manifesto for Sustainable Cities and the Built Environment' presents a set of policies related to energy, water, materials, finance and infrastructure to achieve the 'Africa we want' [25].

Table 5 Link between the African Manifesto for Sustainable Cities and Built Environment and Optimising the Resource Performance of Hotel Buildings with a View to Zero Carbon Emissions

				
Reduced energy demand and environmental footprint.	Rational use of water.	Reduction of embodied energy in materials.	Green certification facilitates access to green financing	Sustainable and resilient hospitality.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24JUL808

REFERENCES

[1]. UNWTO. (2021). Glasgow Declaration on Climate Action. Glasgow: UNWTO.

[2]. UNEP. (2020). Emissions from the building sector have reached an all-time high, but the low-carbon recovery from the pandemic can help transform the sector, says a UN report. (Accessed in December 2023). https://www.bing.com/ck/a?!&&p=26869c3614287ab8JmltdHM9MTcwNzg2ODgwMCZpZ3VpZD0yNjhlOTQwMS05MmVhLTZkY2EtMDVkZi05YTk3OTNmMzZjZTUmaW5zaWQ9NTE3NA&ptn=3&ver=2&hsh=3&fclid=268e9401-92ea-6dca-05df-9a9793f36ce5&psq=Les+%c3%a9missions+du+secteur+du+b%c3%a2timent+o

[3]. Sustainable Hospitality Alliance, IFC. (2023). UNLOCKING INVESTMENTS FOR GREEN & RESILIENT HOTELS.

[4]. EU. (2018). DIRECTIVE (EU) 2018/844 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL. Official Journal of the European

[5]. Soué, E. N. (2015, novembre 7). COP21: Les efforts du Cameroun. Journal Le Droit.

[6]. African Union. (2013). Agenda 2063. https://au.int/agenda2063

[7]. MINEPAT. (2020). ENVIRONMENT AND NATURE PROTECTION. MINEPAT, National Development Strategy 2020-2030 (p. 74). https://minepat.gov.cm/wp-content/uploads/2022/04/Strategie-Nationale-de-Developpement-SND30_Fench.pdf

[8]. UN. (2023). Population. (Accessed in December 2023). https://www.un.org/fr/global-issues/population

[9]. World Bank. (2023). Water Resources Management. (Accessed in December 2023). https://www.banquemondiale.org/fr/topic/waterresources management

[10]. WorldData. (2023). Population growth in Cameroon. (Accessed in December 2023). https://www.donneesmondiales.com/afrique/cameroun/croissance-population.php#:~:text=Croissance%20de%20la%20population%20en%20Cameroun%20Entre%201960,L%27augmentation%20la%20plus%20faible%20en%202015%20avec%201%2C46%25.

[11]. World Bank. (2023). Access to electricity (% of population) - Cameroon. (Accessed in December 2023). https://donnees.banquemondiale.org/indicator/EG.ELC.ACCS.ZS?locations=CM

[12]. Cameroun actuel. (2023). Les tarifs d'électricité à la hausse : voici les nouveaux prix. (Accessed in December 2023). https://camerounactuel.com/les-tarifs-delectricite-a-la-hausse-voici-les-nouveaux-prix/

[13]. Vierra, S. (2016). GREEN BUILDING STANDARDS AND CERTIFICATION SYSTEMS. Whole Building Design Guide.

[14]. La Clef Verte. (2023). PRÉSENTATION DE L'ÉCOLABEL CLEF VERTE. La Clef Verte. (Accessed in December 2023). https://www.laclefverte.org/le-label/pr%C3%A9sentation/

[15]. Green Globe. (2023). Green Globe International Standard for Sustainable Tourism. Green Globe. (Accessed in December 2023). https://www.greenglobe.com/

[16]. Vacances Vertes. (2023). Chouette Nature : un label français de tourisme durable. Vacances Vertes. (Accessed in December 2023). https://www.vacances-vertes.net/

[17]. IFC. (2018). IFC, User's guide to the Platform EDGE.

[18]. MINTOUL. (2023). Energy efficiency requirements for hotel buildings in Cameroon. (G. M. Sokamte, Interviewer)

[19]. Presidency of the Republic. (2016). Law of 18 April 2016 governing tourism and leisure activity in Cameroon. Cameroonian Law: https://www.droitcamerounais.info/files/712.04.16-Loi-du-18-avril-2016-regissant-l-activite-touristique-et-de-loisirs-au-Cameroun.pdf

[20]. MPEER, MCLU. (2020). Inter-ministerial order no. 134/MPEER/MCLU of 18 November 2020 https://www.dgenergie.ci/fichiers_uploades/files/Arrete-interministeriel-n-134-MPEER-MCLU-EE-BAT.pdf

[21]. ASDER-Arcanne. (2022). MOOC Rénovation performante. MOOC Bâtiment Durable. (Accessed in December 2023). https://lms.mooc-batiment-durable.fr/courses/course-v1:ASDER+ASDERclefs+SESSION08/courseware/

[22]. UN Habitat. (2014). SUSTAINABLE BUILDING DESIGN FOR TROPICAL CLIMATES. Nairobi: UN Habitat.

[23]. Damvent. (2023). VMF. Damvent: (Accessed in December 2023). https://damvent.com/en/product/vmf-8

[24]. Edge Buildings. (2023). IFC and green-buildings. Edge Buildings: https://edgebuildings.com/about/ifc-green-buildings/

[25]. Africa Regional Network. (2022). AFRICA MANIFESTO FOR SUSTAINABLE CITIES & THE BUILT ENVIRONMENT. https://worldgbc.org/wp-content/uploads/2022/07/WGBC-Africa-Manifesto_draft-2022.pdf