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Proposal a New Energy Certification with Multi-Criteria Analysis of Strategies Passives of Tertiary Building in Arid Region

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ABSTRACT

This study aims to develop a new energy certification rating system in hot and dry climates. To do this, sustainable strategies must be applied for tertiary buildings. The methodology consists to evaluate these passive strategies by covering three proportions of sustainability (energy, economic and comfort), with a dynamic simulation. In addition, to calculate energy performance and energy savings indicators, we are carrying out a survey to establish reasonable and fair criteria for case study. In this study, four stages were carried out data collection and analysis, evaluation of the energy performance indicators of the strategies. With a multi-criteria analysis, we can evaluate indices of the energy performance of a building, in order to set up a new energy certification, which can allow energy savings and maintain comfort.

1. INTRODUCTION

To reduce energy consumption, the building sector is of specific interest to Energy consumption and reservation, represents the main concern for environmental, economic and social problems. We focus, in this study, on Sub Saharan area with inapplicable of thermal and energetic regulation of construction and electricity is an essential reason. In this region, it is important to proposal new energy certification is a sustainable strategy for an energetic consumption.

The main of this work is proposing a procedure for Energy Certification applied energy retrofit sustainable strategies specific uses of the construction in this context. In the countries which importing energy in the region Sub Saharan, such as South of Algeria, the building sector is the principal consumer of energy (60% of total primary energy).

It is, therefore, necessary to reduce the economic and environmental impact of this sector by promoting new systems of buildings with low energy consumption. Traditionally, in this context, the local materials with low energy costs and low environmental impact were used. Today, global materials used such as cement, aluminum, and concrete are increasing energy consumption and a negative environmental impact. In this region, the balance between the building envelope and the adaptation of active installation presents the complexity of the energy classification process.

Lowering energy consumption in cities, in particular from fossil energies, has multiple benefits, for the inhabitants" health and quality of living, the fight against climate change, the operating costs for the municipality and the expenses that bear upon its inhabitants - in a nutshell, for the attractiveness of cities [1, 2].

The methodology aims to understanding about the complexity and the difficulties in applying the results to a new energy certification of construction.

2. THE LITERATURE REVIEW

We are going to do a census of research concerning the proposal for an energy performance certification and labels for the building sector. We first study the underlying theoretical mechanisms that can justify quality certification and their application to the energy performance of buildings. We can notice that almost all of the literature on the impact of energy certification on consumer choice and improving the energy performance of buildings has been completed. Energy performance certifications and labels have been developed all over the world. While Europe has chosen to implement a compulsory certification theme, other countries such as the United States leave building owners free to obtain certification or not [3, 4]. Some studies have been carried out to know the proportion of energy certification Ernesto Efrén Velázquez Romo, 2015, offers an excellent review on the development of the methodology of decision support, which consists of sixteen energy performance indicators, covering three dimensions of sustainability: environmental, economic and user comfort aspects. the method is based on a global approach of the life cycle, with a calculation of the indicators adapted to the buildings in the first phases of design [5, 6].

Another study carried out by Bribia et al. [3] includes environmental information in energy certificates, in particular CO_2 emissions. Reducing the environmental impact of the building sector requires appropriate assessment methods [4].

In Italy, extensive data collected since the application of the energy labeling of buildings has provided valuable and useful information for planning the future of energy efficiency. However, the indicators provided by energy certificates are not suitable for targeting the energy renovation of buildings on a regional scale.

For example, in arid regions the index of the compact form of building is clearly based on geometric characteristics with

little openness. He observed that the proposed labels correctly distribute the dataset, depending on the potential for energy retrofitting of buildings. This work tends to overcome on passive strategies as an indicator, suitable for classifying buildings according to renovation characteristics. The proposed framework validated by a case study, in which a large data set of office buildings assigned with the new index.

ADRA N. has proposed a procedure for the energy certification of residential buildings, called "EC-Pro", based on a distinction between standard consumption and real consumption, depends on the real behavior of the occupants in the calculation of real consumption, with the calculation of occasional earnings. The proposed energy certification was considered as an energy policy in the Lebanese context [7, 8].

The studies [9, 10] present an estimate of the energy performance of a room according to a thermal simulation for the study of performance in terms of economy.

Our study in thesis, presented the improving the energy performance of the residential sector in the arid regions (Bechar, Southwest of Algeria), with examined improvements different passives solutions, using to evaluate the indicators of energy performance, to proposing an energy certification [9].

Mothana S., his work is to develop energy labels for new residential construction in the coastal region of East Mediterranean, with a series of field surveys to highlight energy issues of residential buildings in the city of Tartous. The limits of improving energy performance, due to the use of available technical solutions on-site, with a total valuation of viewpoints energy, economic and comfort, determined the new values of the regulatory indices of the new RT2012-EM energy label. The energy label for the different actors of the building to the design of new residential buildings, designed to promote a policy of rational use of energy, through buildings with low energy consumption [11, 12].

2.1 Energy certification on energy: Performance of building is mandatory or voluntary

Energy performance certification is a key policy instrument that can reduce energy consumption in buildings. It provides decision makers, occupants, and the real estate market with objective information about a given building regarding the determined energy performance level. Often, certification is most effective when complemented by other initiatives that support energy efficiency [13-15].

The direct benefits associated with building certification programs include reductions in energy and CO_2 emissions and broader environmental benefits; increased public awareness of energy and environmental issues; lower costs for users; and improved building data, which can be used for future policy development to further improve the energy efficiency of the building stock [16-18].

Certification is not always taken into account consumers. In practice, we have already mentioned the difficulties consumers have in understanding energy certification and their inattention.[19] Our study of the literature tends to confirm that the energy rating is a numerical and categorical indicator of energy performance. Energy certification of buildings. Energy performance should be mandatory, by increasing superior energy performance, which is valued in the real estate market [20, 21].

The objective of this work is to develop an energy certification of tertiary buildings in the arid region. To achieve this goal, we conducted a series of field surveys to highlight energy issues of buildings in the city of Bechar, and establish a database for the repository construction methods, energy systems access and usage of the occupants.

2.2 Methodology and Evaluation of an Energy Certification

In European countries, the energy certification processes for buildings are a fundamental step towards improving buildings, energy efficiency [22, 23]. To evaluate the impact of environmental and energy certification of the building, three methods are developed:

1. Methods environmental type **check list;** conventional on Consumption, applied to new construction. An asset rating is a calculated rating
2. Methods environmental life assessment cycle of building **(ACV).**
3. Methods proposed system of notation

Two methodologies of an energy certification described, based on two separate assessment systems:

- **Asset-rating**: appear on energy performance certification and are found by calculation, while the operations are based on metered data.
- **Operational-rating**: archives the actual energy use over year, and benchmarks it against the building of similar type.

This method allows to measure the Energy-Saving and quantify there, based on standard consumption and building use.

On the other hand, the asset rating provides no information about how the building is operated in practice.

3. DYNAMIC SIMULATION OF BUILDING

3.1 Data collection and analysis of strategies sustainable of the building

In this step, we continue the analysis of different improvements with a simulation approach, focuses to evaluate the effect of all these systems on energy performance of building stock and energy consumption in the short and long term in the arid context.

4. MATERIALS AND METHODS

The model of the building has been chosen was a laboratory of research (university Tahri Mohamed Bechar). We have calculated with Trnsys dynamic simulation and Stress tool and date climate of bechar. Concerning climate, the model was simulated employing Meteonorm weather data of Bechar of the last twenty years. The Geometric characteristics of the building was included (Table 1).

Table 1. Energy consumption of building with gains, air infiltration [24]

Q	With gains, air infiltration	Without gains air infiltration
Qheating	199.22	144.94
Qcooling	37.46	123
Q Gain	371.67	91.25
QAir	0	0
Q Total	607	358,5

The construction of this model has required a determination of Thermal-Physical of a building envelope: opaque and glazes surfaces and Climatic context [25, 26].

Table 2. Description of different systems retrofits (e and coefficient U-value)

Scenario	Composition	Thickness
Thermal insulation	Plaster exterior	0.02
	Finish coat	0.02
	Insulation plate with natural fibres	0.05
	Red brick	0.20
	Blade of air	0.02
	Hollow Brick	0.10
	Gypsum plasters	0.02
TROMBE Wall	Mechanical Windows	0.04
	Brick	0.2
	Blade of air	0.02
	Brick	0.10
	Plaster	0.02
Double skin glazing	Exterior cement	0.02
	Cement plaster	0.02
	Brick concrete	0.2
	Insulating plate expanded polystyrene solid	0.08
	Cavity	0.02
	Glass window (doubl glazing)	0.02
	External rolling blind	0.02

5. RESULTS AND DISCUSSIONS

We can calculate the cooling and heating and light of local on KWh/ m^2, which are necessary for calculate: the investment cost and bioclimatic indicator, the systems such as double-wall facades (Table 2), thermal insulation and Trombe wall and ventilated windows, are already decreasing energy consumption in building envelopes. We can investment costs for the efficient for each system if we calculate the economic indicator L'Eco and the investment coast TR (Table 3).

The economic impact of these strategies can be a loss of the economic justification for the project [11].

Table 3. Evaluation of indicators of the energy performance of strategies sustainable

System Indicator	Initial building	Thermal insulation	Wall Trombe	Double skin lighting
Cep Heat	477.71	201.44	223.00	160.12
Cep Cool	220.73	147.25	144.5	161.25
Cep lighting	4.5	4.5	4.5	4.5
Cep ECS	45.5	45.5	45.5	45.5
I"Ecoéo	-	349.75	335.11	376.57
Cep (KWh/m^2)	748,44	398,69	413,33	371,87
Bbiobât points)	698.46	572.63	613	503.99

With:

- Bbiobât. (Bbiobât= 2Bheating + B cooling + 5 lighting)
- Cep= Cep-chauffage + Cep -climatisation+ Cep – éclairage+ CepECS + Cep-auxs+ Cep-auxv (Cep auxs= cep auxv=0 et cep éclairage= 4.5 KWh/m^2 et cepECS= 45.5 KWh/m^2.

5.1 Evaluation multi-criteria the retrofits strategies sustainable of the building

However, our certification does consider the multi-criteria analysis of different strategies. Both energy certification provide certain criteria such as (Table 4):

- Criteria n°1: Environmental: _ CO_2 emissions for heating, cooling and hot water and lighting (kg CO_2/m^2 per year)
- Criteria n°2: COMFORT: factor
- Criteria n°3: Bioclimatic: S/V losses surface to volume ratio or shape factor or loss compactness [m-1] and Bbio (points) [indicator bioclimatic
- Criteria n°4: ECONOMICAL; Energy coast "L"éco" and cost investment TR
- Criteria n°5: ENERGETIC; Cep it is necessary to Identical Weighting/scoring for all criteria

Table 4. Evaluation multi-criteria the retrofits strategies sustainable of the building

	NOTATION*3	1	2	3	4	5	6
Comfort	IPS min	0.15	0.30	0.40	0.60	0.75	1
Energy	Cep max KWh/m^2.an	>450	350-450	350-250	150-250	150- 100	<100
Economic	Investment costs DA/m^2	15000-20000	10000 -15000	5000-10000	1000-5000	0-1000	0
	Temps de Retour TR	0	0-3 month	1- 2 year	2-4 years	4-8 years	8-10 years
	COST electricity DA	>60000	48000-60000	36000-48000	36000-24000	24000	12000
Environmental	Emission CO_2 per/ kg	15000	12000-15000	9000-1200	6000-9000	6000	3000

6. CONCLUSION

In this work, we propose an energy certification to reduce the initial building construction coast, using local low-embodied materials and savings to offset the renewable energy installations.

Evidence is growing that sustainable building provides financial rewards for building owners, operators and occupants.

A typical building in the desert climate of Algeria has lower annuals costs for energy. These reduced costs do not have to come at the expense of higher first costs. It is modelled software for the case of conventional construction and when using local construction materials.

This resulted in net energy saving up to 65% in the case of double glazing and investment coast to 10 years.

Our multi-criteria analysis made it possible to propose a new energy certification generally not taking into account the aspects linked to energy certification with the improvement of building renovation systems.

Therefore, it can result in obtaining better energy classification while producing economical energy

consumption.

Consideration should be given to the factors taken into account to convert the final energy into CO_2 emissions. As we have shown, in the case of our case study, it is important to promote the integration of passive energy systems in buildings, and offering greater thermal comfort for the occupants. The energy certification process for buildings can be seen as enabling the promotion of sustainable buildings with low energy consumption and high efficiency and innovation of choice in the construction sector.

The use of low-impact natural materials available in the territory can minimize energy consumption in construction.

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