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Algerian Strategy in the Context of Sustainable Development: The Case of Green Building

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Abstract

Energy issues and global climate remind us of the urgency of wise use of resources and the necessary changes in the construction industry. Largest consumer of energy and the third emitter of greenhouse gases, it also has other effects, such as the emission of waste, noise, disturbance of the microclimate, consumption water, and groundwater pollution, it would be time to change our gaze to habitats with high potential savings, ecological habitat should meet all these expectations. . In this article we will try to interpret our policy that addresses all the issues mentioned above, and take a challenge to gradually enter into the era of multiple energy and sustainable development, especially in the field of habitat, then we will present a concept of ecological habitat conducted in the city of Tlemcen (west of Algeria).

Keywords: *Energy, resources, ecological, policy, sustainable.*

1. Introduction

A sustainable energy future will continue to allow fossil fuels, with a more efficient and a more serious emissions of greenhouse gas emissions. In the event of a strong commitment of states, coupled with a good collaboration with the private sector, to diversify the energy mix, provided that governments commit themselves firmly in research and development and the private sector accepts to work.

The Algerian government invests heavily in sustainable development and scientific research, new laws on sustainable housing, reducing CO_2 emissions Shows the interest of the Algerian state to promote sustainable development; other the legislative side, the national scientific research encourages researchers to engage in research that is the case of PNR projects and achieving the pilot projects, the organization of international meeting to develop new concepts

On our side, mobilization is a major deal with significant risks for energy supply and climate change, so it is imperative to move towards more sustainable solutions, do not have the disadvantages of fossil fuels in terms of depletion of resources or greenhouse gas emissions. Knowing that the housing sector accounts for 45% of the country's overall energy expenditure (to transport) and a quarter of carbon dioxide released into the atmosphere, and with regard to our international commitments (international agreements: Kyoto , Rio de Janeiro, Barcelona, Copenhagen), it is essential that the building is no longer a mere consumer of energy, but become a producer and participant in its autonomy. Taking as a starting point led studies on this topic [1, 2, 3], the work presented here, in part, to develop year aims ecological house in Tlemcen (west of Algeria), and study all its aspects.

2. Passive Constructions in Algeria

The energy consumption of buildings in Algeria is estimated at 40%, and in this context, the Algerian government intends to achieve 3000 housing and ecological renovation thermal 4000 other existing homes as well as 20 for the tertiary sector (energy audit **)** in the five-year program 2010/2014.

With its solar potential estimated at more than 3000 hours of sunshine per year, Algeria is one of the Countries most likely to promote solar energy, however, the national policy of development of renewable energy technologies must focus on a financial strategy able to allocate adequate resources to this sector for the future.

Just remember that the implementation of the law 99.09 on the control of energy in the building sector, was reflected by the April 24, 2000 promulgation of Executive Order No. 2000-90 regulating heat in new buildings. It aims, the introduction of energy efficiency in new buildings for residential use and another, and in parts of buildings constructed as an extension of existing buildings.

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To associate an optimization practices, a pilot project was set up in Souidania, favoring the use of local materials and alternative energy sources .. The MED-ENEC Pilot Project in Souidania was designed to meet these conditions, the stage of construction to that use. [4]

The project results showed that the building's energy consumption was reduced by 56%, while showcasing traditional building techniques, often optimal in terms of energy. Thus, the use of adobe (mud bricks), natural light, the optimum orientation of the building or natural ventilation in summer have to combine in a single project the cultural, ecologically and economically.

Time profitability of the project was estimated at 86 years due to a surcharge of more than 40% (over 300,000 DA).

3. Project of Passive House in Tlemcen:

The house is located in Tlemcen (Western Algeria), of a surface of plate of 150 m ² conceived in R+1 stages, the downstairs comprises a hall, a garage, a stay, two bathrooms, two rooms, a kitchen, a wash-house and a dressing, on the floor, it y' has an office, an attic as well as a mezzanine, the parts as their surfaces are represented on fig. 1 and 2. The components of the ecological house, the coefficients of thermal transmission as well as the detailed surfaces of each part, are indexed on tables 1 and 2. The architecture and the provision of the house enable him to better collect the solar radiation since the parts with living are directed in the south east and the western south; this principle of bioclimatic architecture is required for the ecological design. We chose wood like material of design, for its various advantageous characteristics: since wood has a weak thermal inertia, its cost of construction is more economic, it releases only from atmospheric CO_2, [5] finally, its coefficient of thermal transmission is rather low, compared to other ecological materials (as the brick monomur), which enables him to be regarded as being a super insulator. Thus the external walls, will be with framework wood of 30 cm, and comprise a layer of 22 cm cellulose wadding (U = 0,163 W/m².K). The flagstone isolated by 20 cm from cellulose wadding (U = 0,118 W/m².K). We will use also a very powerful double glazing (20 mm U = 1.1 W/m².K). The isolated external doors go beings installed so as to ensure a good air tightness (U = 0.94 W/m².K). From there, we must reach 15 kWh / m².year for heating needs, the total energy demand must be less than 50 kWh / m². year (against 220 kWh / m². year for a conventional home, which is equivalent to an invoice economic between 0.03 and 0.04 € / m^2 cons € 0.32 / m^2 for conventional house.

The external brick walls of the conventional house, comprise a layer doubles walls of 30 cm (the thermal coefficient of transmission U = 3.5 W/m².K), wall interior in bricks have a thickness of 13cm, the flagstone 20 cm of concrete (U = 4 W/m².K), simple glazing, the windows and the doors are out of wood (U = 2.5 W/m².K), the external iron doors (U = 5.8 W/m².K).

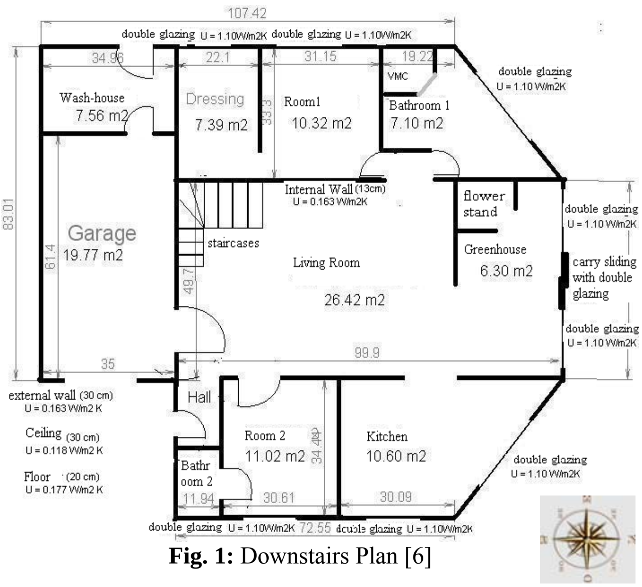

Fig. 1: Downstairs Plan [6]

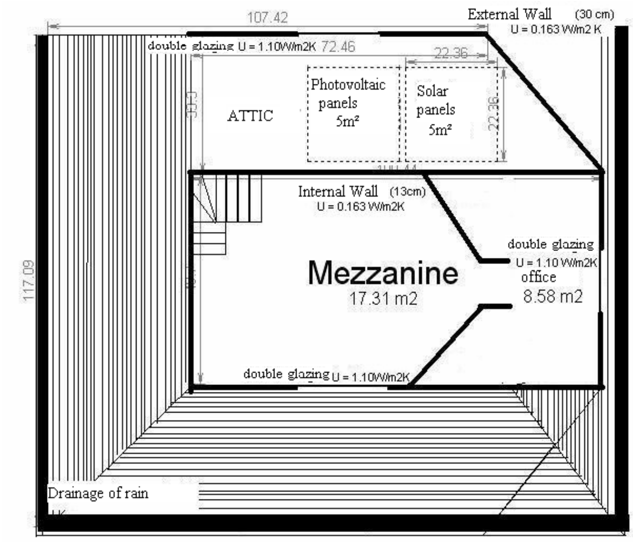

Fig. 2: Plan of the stage [4]

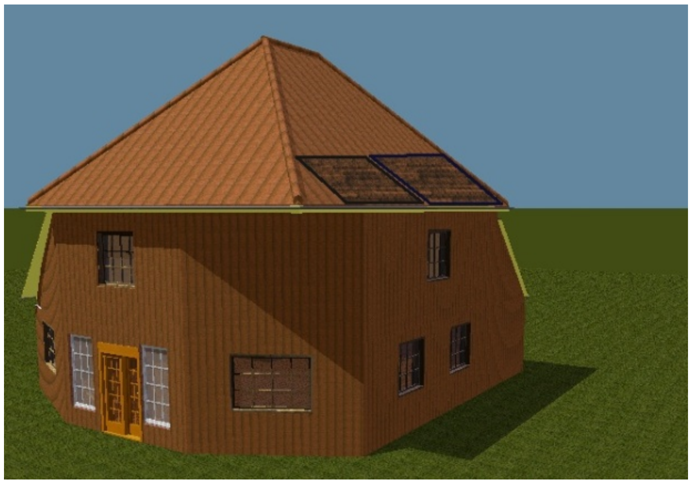

Fig. 3: Picture illustration of the passive house (South South-East) [6]

4. Results and Discussion:

On the following table we indexed the various losses due to the heating in each element of the house, with a difference in temperature of 26°C, which is the difference between the room temperature and the basic temperature of the town of Tlemcen.

The calculation of loss DBP of a house:

DBP = Σ . DP (Ti – Te)……… Watt

DBP = [Σ (U.A) + Σ (Y.L)] (Ti – Te) ….Watt/°C

- U = surface Coefficient of transmission [W/m^2°C]
- A = interior Surface of each element of wall [m^2]
- Y = linear Coefficient of transmission in W/m°C of the connections of element of walls giving on outside
- L = interior Length of each house [m]
- Ti = the basic interior temperature [°C]
- Te = outside temperature [°C]

Table 1: Calculation of the losses due to the heating for each element of the house [4]

Losses		Walls	Windows	Doors	ceiling	Total losses [Watt]
Coefficient U		0.163	1.1	0.94	0.118	
Ground floor						
Living room	S	65.88 - 12.6	-	12.6	36	
	U.S	8.68	-	11.844	4.248	24.764
greenhouse	S	42.12 - 11.7	4.5	7.2	14	
	U.S	4.958	4.95	6.768	1.652	18.328
Room 1	S	34.80 – 5.85	2.25	3.6	10.35	
	U.S	4.718	2.475	3.384	1.221	11.794
Dressing	S	29.91 – 4.05	2.25	1.8	7.36	
	U.S	4.21	2.475	1.692	0.868	9.245
Bathroom 1	S	39.42 – 6.3	4.5	1.8	10.66	
	U.S	5.4	4.95	1.692	1.257	13.299
Bathroom 2	S	16.14 – 2.05	0.25	1.8	2.14	
	U.S	2.296	0.275	1.692	0.25	4.513
Kitchen	S	45.23 – 8.55	6.75	1.8	15.18	
	U.S	5.978	7.425	1.692	1.791	16.882
Room 2	S	35.10 – 5.85	2.25	3.6	10.52	
	U.S	4.76	2.475	3.384	1.24	11.854
Garage	S	52.03 - 5.4	-	5.4	21.46	
	U.S	7.6	-	5.076	2.53	15.206
Wash house	S	30.75 – 3.6	-	3.6	7.69	
	U.S	4.425	-	3.384	0.907	8.716
Hall	S	15.62 – 3.6	-	3.6	2.02	
	U.S	1.959	-	3.384	0.238	5.581
Stage						
Mezzanine	S	52.65 – 6.3	4.5	1.8	17.31	
	U.S	7.55	4.95	1.692	2.042	16.234
Office	S	47.79 – 5.85	2.25	3.6	8.58	
	U.S	6.836	2.475	3.384	1.012	13.707
Attic	S	55.08 – 6.3	4.5	1.8	25.69	
	U.S	7.95	4.95	1.692	3.03	13.788
Total						**183.911**

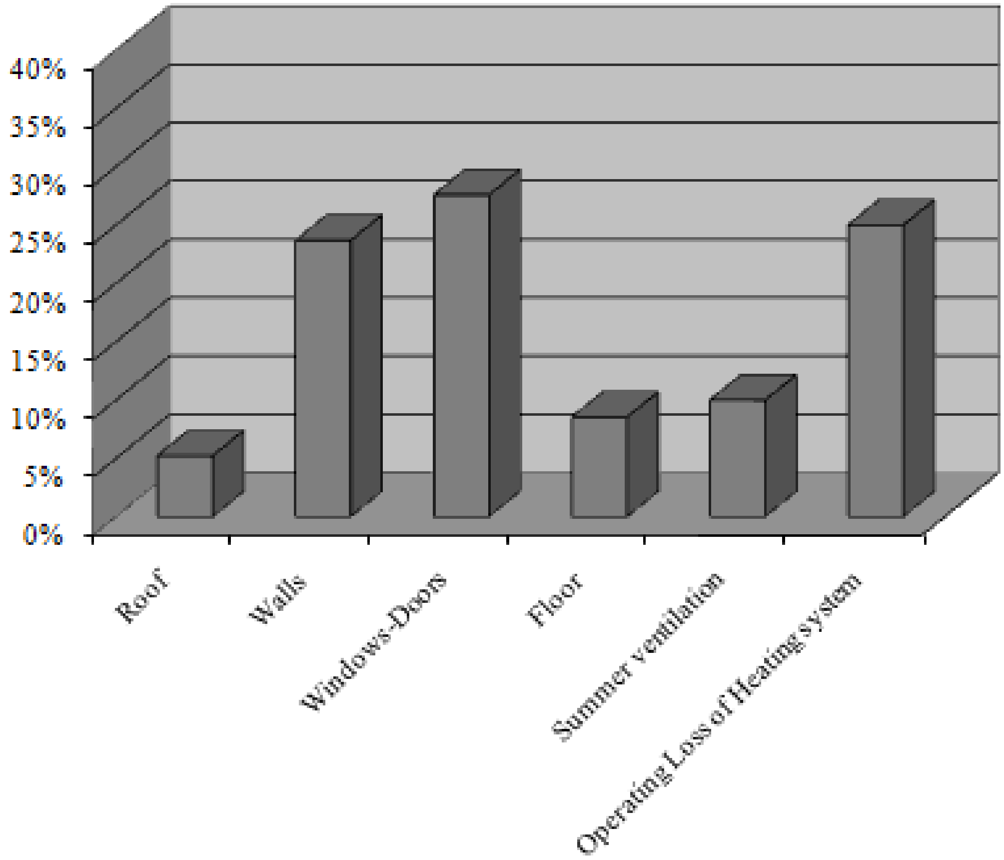

Fig 4: Energy assessment of the ecological house

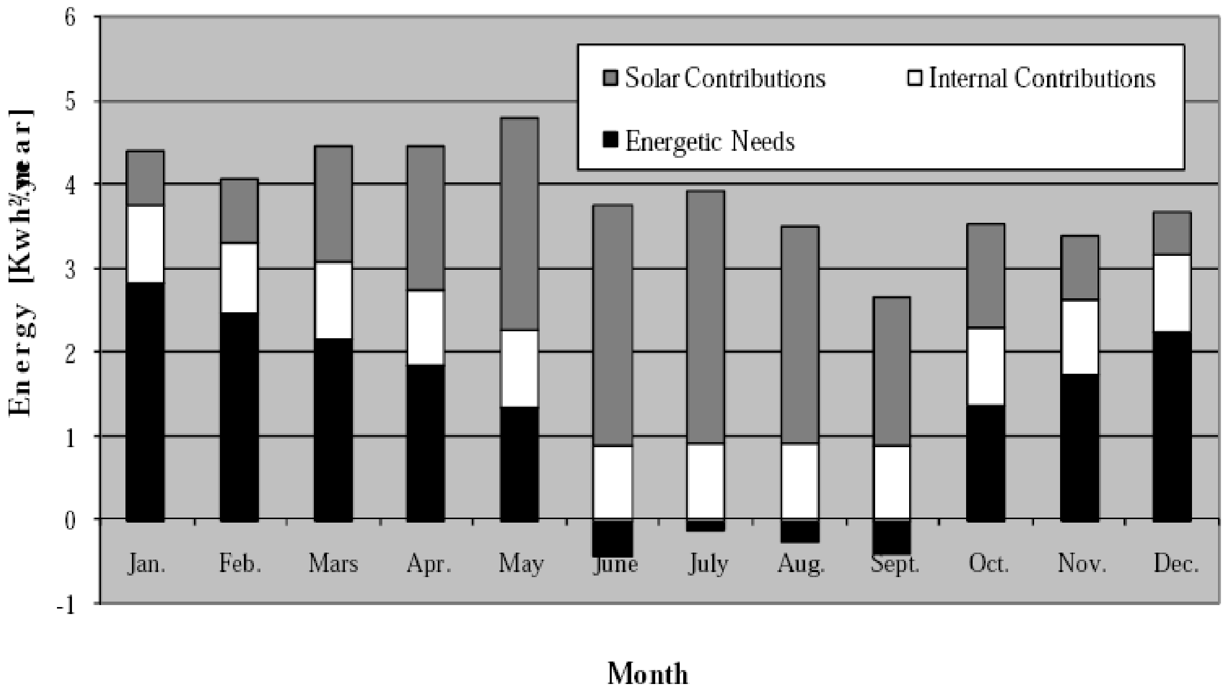

Fig 5: Relationship between Energy needs, solar contribution, and internal contribution (Ecological House)

5. Energy Balance sheet:

Simulation is used for the calculation of the energy assessment, therefore we notice that energy consumption is due mainly to ventilation, with the glazings and that with the doors thus with the losses due to the heating. In order to determine the exact energy balance sheet of the two houses, we calculated the energy requirements of each house during one year, the solar contributions, and internal contributions.

Figure 5 above represents the evolution in the time of the couple contributions/energy requirements in the house. The study realized proved that the internal contributions are due to the human heat of the inhabitants (Family made up of 4 people), knowing that each person releases 80 W.

- The direct solar contributions represent the energy collected in the habitat in the form of heat without special provision of collecting (through the windows).

- The indirect solar contributions come from an accumulating wall interposed between the sun and the room to be heated. It absorbs the solar radiation, transformed at once into heat and it transmits then this thermal energy with some delay in the room of dwelling.

The difference is so outstanding, that one could even believe that the solar and internal contributions can largely reduce the energy needs for the house. For example for January, the consumption of the house will not even reach the 3 Kwh/m ², which accounts for the 1/12 of usual consumption. The sum of the internal and solar contributions can reach it only 1.6 Kwh/m².year. Consequently, the needs would be largely compensated, with possibly a surplus, which could be stored

Table 2: Economic Assessment for the house [7]

	Conventional House	**Ecological House**	**Difference**
1st Finding	unspecified orientation	House face the sun	
Surface glazed house	20 m^2 of glazed surfaces	Oversizing of the openings (25 et 30 m²) of surface glazed	+ 100 €
Conception and thermal study	-	300 €	300 €
Surface ground	16.000 €	16.000 €	-
Infrastructures	4.500 €	4.750 €	250 €
Superstructures	4.500 €	4.750 €	250 €
Use of solar radiations	-	Breezes sun or caps	100 €
The second works (insulation, electricity, heating, plumbing)	10.000 €	10.500 €	500 €
System of Cooling system	Air-conditioners	ground-coupled heat exchanger	+ 500 €
Type of heating system	Boiler supplied with Natural gas	Solar panels and stove	+ 2.000 €
Electricity	Public Network(P.N)	P.N + Photovoltaic Panels + ecological Lamps	+ 1.500 €
Total Cost.	35.000 €	40.500 €	**5.500 €**
Global Energy Consumption	220 KWh/m².year	43 kWh/m².year	**Profit of 177 Kwh/m².Year**
Approximate annual amount of the invoice	**380 €**	**200 €**	**180 €**
Cost over 15 years	Conventional House	Ecological House	
Initial construction	35 000 €	40 500 €	**5 500 €**
Consumptions	5 700 €	3 000 €	- 2 700 €
Upkeep	12 000 €	9 000 €	- 3 000 €
Total	**52 700 €**	**52 500 €**	**- 200 €**

6. Economic Assessment:

On summary table above (Table 1), we indexed the difference in design, of materials, and of the cost between the two houses; we reported the costs associated with the house over 15 years by adopting the approach that the structure of the building is conceived to last at least during all this time, by undergoing the repairs necessary. This highlights well the important hidden costs of a house:

In the conventional construction industries, the maintenance costs over 15 years amount paying half of the one second complete construction of the house, whereas, in the ecological versions, they represent only the quarter of the cost of construction.

7. CONCLUSION

Our country must become more involved in investments linked to sustainable development, especially a green building, especially at the present time, the price of oil continues to rise, even up to the experts a record price and make profit, the investment opportunity in the passive house, in order to achieve socio-economic gains, such as reducing consumption, reflecting a decrease in energy bills household and the state, especially the creation of thousands of jobs directly or indirectly related to green design, especially as such, and finally the results obtained, we were able to find materials that do not contradict lot and that helps to reduce energy costs in time and use of renewable energies such as earth or the sun. Only the houses demand a greater cost when performing. In addition, over time, these buildings will require less energy to heat, light ... which represent savings in addition to other buildings. Thus, the ecological habitat is more a question of choice of means, and which falls within the framework of sustainable development.

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