The Impact of Building Orientation on Energy Consumption in a Domestic House in Desert Climate

Omar Bourass, Aziz Et-Tahir

***Abstract:** Morocco has set the goal of introducing new methods of construction and positioning among the leaders in the African continent in the field of renewable energy and sustainable buildings, efforts are therefore focused on developing an energy efficiency policy. Orientation is one of the key factors that impact building's energy consumption, it's a very important factor to consider in order to avoid summer overheating and limit winter losses. The purpose of this scientific article is to study the impact of the orientation of a house on its annual energy needs in terms of heating and cooling essentially, but also its internal and solar energy gains and its losses in relation with infiltration, transmission and ventilation. In this regard, simulations were carried out with eight different possible orientations on a small house, located in one geographical area known by its desert climate. The final purpose is to determine the suitable orientation for dwellings in this geographical area for energy saving while guaranteeing the thermal comfort. Based on our analysis, it was revealed that a well-orientated house can save a considerable amount of energy throughout its life cycle.*

***Keywords** : Building energy consumption, Building orientation, Energy Efficiency, energy saving, Sustainability.*

I. INTRODUCTION

Unlike some of its neighbors in the region, Morocco is highly dependent on imported energy. Over 91% of energy supplied comes from abroad: coal, oil and oil products from world markets; gas from Algeria; and imported electricity. This is a significant burden on the balance of payments, and, insofar as some energy supplies are subsidized, a drain on the budget. [1]. In order to deal with this situation, Morocco has developed a strategic vision for the preservation of energy and after a few years, Morocco has become one of the major actors of the energy transition in the world and more particularly on the African continent. Indeed, the government has proceeded with energy reforms based on the priorities outlined in its 2009 National Energy Strategy to enhance energy supply diversification. Furthermore, it has stepped up its role in international action on climate change, ratifying the Paris Agreement, setting a new national climate policy and hosting the United Nations Conference of Parties (COP22) summit in Marrakesh in 2016 [2].

One of the major priorities of the new energy strategy developed by Morocco is to increase the contribution of renewable energies in electricity production to 42% by 2020 and to 52% by 2030. In the world, the buildings and buildings construction sectors combined are responsible for 36% of global final energy consumption and nearly 40% of total direct and indirect CO2 emissions [3].

In Morocco, the building is the largest consumer of final energy with a share of 25% of the total energy consumption of the country, of which 18 % reserved for residential and 7% for the tertiary sector and this energy consumption is expected to increase rapidly in the coming years [4]. The orientation is one of the key factors that minimize the building energy consumption and one of the important parameters of every energy efficiency policy that aims to rationalize energy consumption and diminish the energy bill.

II. METHODOLOGY

To understand the impact of a home's orientation on both of its annual energy needs in terms of heating and cooling, its internal and solar energy savings and finally its energy losses in terms of infiltration, transmission and ventilation, we studied a thermal behavior of a simulated small house, located in the city of Errachidia in the South-East of Morocco, with a specific technical and architectural characteristics that are defined and detailed below and thus we established simulations with at each time, a well-defined orientation.

For this purpose, we worked with "TRNSYS 16" a complete and extensible simulation environment for the transient simulation of systems, including. It is used by engineers and researchers around the world to validate new energy concepts, from simple domestic hot water systems to the design and simulation of buildings and their equipment, including control strategies, occupant behavior, alternative energy systems (wind, solar, photovoltaic, hydrogen systems), etc. [5].

We used a "type 56" a multi-zone building model of TRNSYS and its visual interface "TRNBuild". To generate meteorological data for our geographic area, we used Meteonorm, a meteorological database containing comprehensive climatological data for solar engineering applications at every location on the globe.

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It’s a standardization tool permitting developers and users of engineering design programs access to a comprehensive, uniform meteorological data basis. [6].

III. METEOROLOGICAL CHARACTERISTICS

The city of Errachidia is located 1045m above the sea, it’s characterized by its desert climate whose main characteristics are detailed below (the historical data generated from Meteonorm is 1991–2010 for irradiation and 2000–2009 for the other parameters):

A. Temperature:

A significant temperature difference, seasonal as well as daily, between very high temperatures on the summer (39°C as average at the month of July) and very low temperatures of the winter (3°C as average in January) (Fig1).

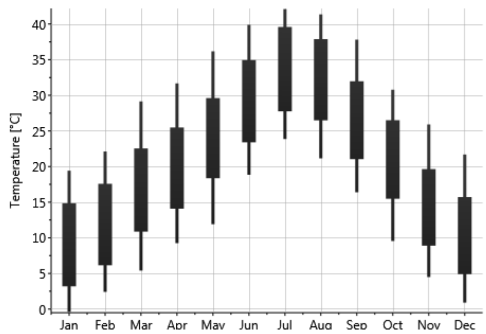

Fig. 1.Average minimum and maximum temperature per month

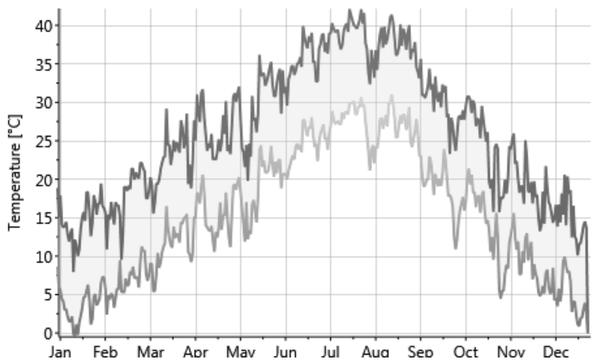

Fig. 2.Minimal and maximal daily temperature

B. Sunshine Duration:

An important astronomical sunshine duration throughout the year, which varies between an average of 15 hours/ day in May, June and July and 10 hours/day in the months of November, December and January. In terms of effective sunshine duration, it varies between 10,2 hour/day in June and 6,7 hour/day in January and December (Fig 3);

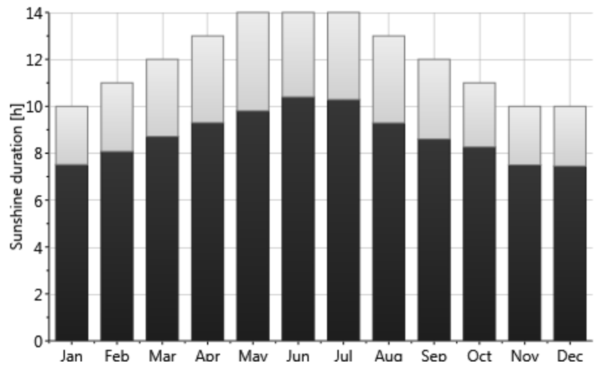

Fig. 3.Sunshine duration(in black) and astronomical sunshine duration (in grey)

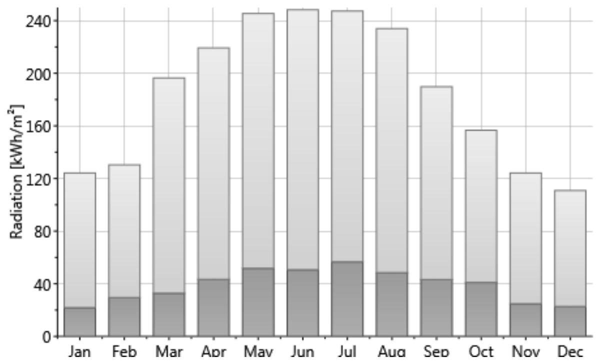

Fig. 4.Diffuse radiation(in dark grey) and global Radiation (in light grey)

C. Global Radiation

Global radiation varies between 110 kwh/m^2 in December, and exceeds 240 Kwh/m2 in May, June and July.

The diffuse radiation varies between 20 kwh/m2 in January and 58kwh/m2 in July (Fig 4);

The daily global radiation varies between 1.9 kwh/m2 marked at the end of November and the beginning of December and 9.2 kwh/m2 at the month of May (Fig 5). These entire data illustrate the energy potential of this geographical area, but also the possible overheating that can face all the dwellings in this area especially in summer.

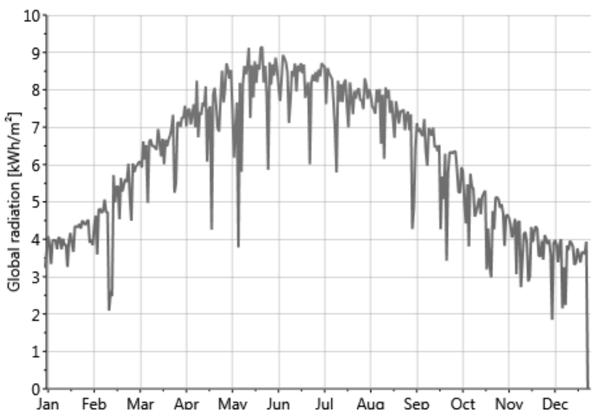

Fig. 5.Daily global Radiation

D. Precipitation:

Precipitation are mainly rainy and rarely snowy, they are very rare and unequally distributed over time and space (between an average of 3mm in July and 29mm in October). The average number of rainy days per year is around 29 days (Fig 6);

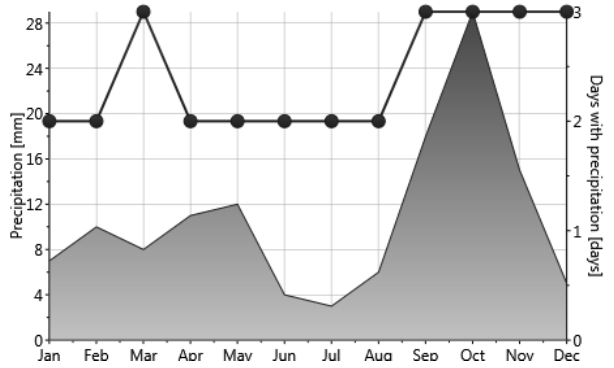

Fig. 6.Precipitation and days with precipitation

E. Wind Speed:

The Statistics of the wind are based on real observations of the weather station of Moulay Ali Cherif at Errachidia, between 01/2013 and 08/2019 daily from 7am to 7pm. [7].

Winds recording average speeds vary between 9km/hr and 19km/hr. They are usually more active in summer and springs seasons. (Fig 7), and they come often from South-West and South-East (Fig 8).

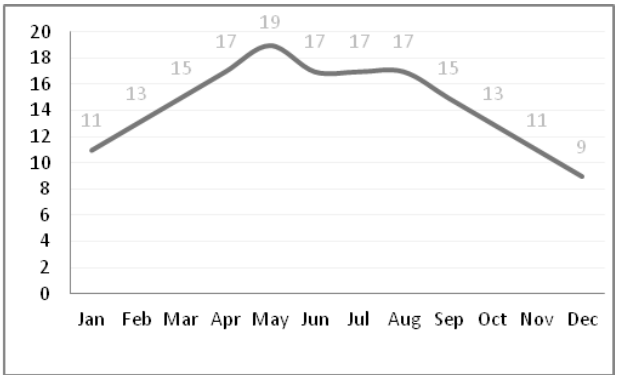

Fig. 7.Average of wind speed km/hr

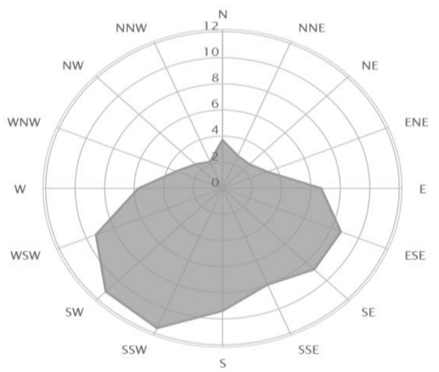

Fig. 8.Distribution of wind direction

IV. TECHNICAL DETAILS AND INTERNAL SCENARIOS

A. Areas and volumes

The house object of our thermal simulations has 69m^2 as gross floor area, 57m2 as a net floor area and 171 m^3 as a net volume. The length of the house is 10,60m and the width is 6,60m. It's composed of a living room, a bedroom, a dressing, a kitchen and a bathroom (Fig 9 and tab 1);

Table- I: Areas and Volume of the Dwelling Reference

Rooms	Height (m)	Surface (m^2)	Volume (m^3)
Room	3,00	9,79	29,37
Living room	3,00	22,95	68,85
Bathroom	3,00	4,69	14,07
Kitchen	3,00	7,25	21,75
Dressing	3,00	6,19	18,57
Hall	3,00	6,15	18,45
Net floor area	-	57,02	171,06
Gross floor area	-	69,96	209,88

Table-II: Technical Details of the Studied Dwelling

Constitution (From The Inside To Out)		Thickness (m)	Conductivity (Kj/Hmk)	Density (Kg/m)	Thermal Transmission (W/m^2)
Floor	Floor Tiling	0,01	1,3	790	1.623
	Cement Screed	0,05	2,52	1300	
	Concret Slab	0,15	4.068	1400	
	Hardcore	0,15	2,52	1800	
Exter Walls	Plaster Mortar	0,02	1,26	1200	0.370
	Hollow Brick	0,10	1,69	720	
	Air Gape	0.11	0,216	1	
	Hollow Brick	0,10	1,227	720	
	Cement Mortar	0,03	4,5	2000	
Roof	Plaster Mortar	0,02	1,26	1200	1.702
	Concret Slab	0.25	4.068	1400	
	Bitumen Roofing	0.02	1.805	1700	
	Cement Screed	0,05	2,52	1300	
	Roof Tiling	0,01	1,3	790	

B. Technical Details

The type of glazing used in this dwelling reference is a simple glazing with a thermal transmission of 5.74 W/m2k

The technical details of construction, used in the studied dwelling for simulations such us thickness, conductivity, and density of materials, are explained below (Tab 2).

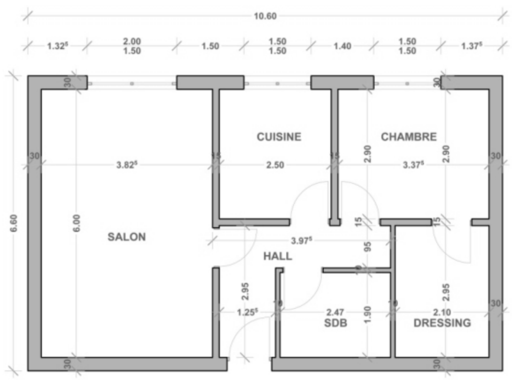

Fig. 9.Plan of the house simulated

- For heating, the set indoor temperature is 22 °C;
- For cooling, the set indoor temperature is 26 °C;
- both heating and cooling are scheduled to maintain the relative humidity between levels of 30% and 60%;
- the infiltration is fixed at 0.6 volume per hour;
- Ventilation rate is set at 0.6 volume per hour; the house is ventilated every day in the early morning between 06 and 07 AM and in the evening between 20 and 21 PM.
- The sensible energy gain to the area due to convection of people inside the area is set for 02 people in mode (Seated light, work, typing), both their sensible and latent heat are 75 W/person, and their adjusted total heat is 150 W/person.
- We used incandescent lamps with a total heat gain of 10 W/m^2; the convective part is 10%.

VI. Results and Discussion

Based on the results (Fig 10 and Fig11), we can affirm that the south side orientations (South, South-East and

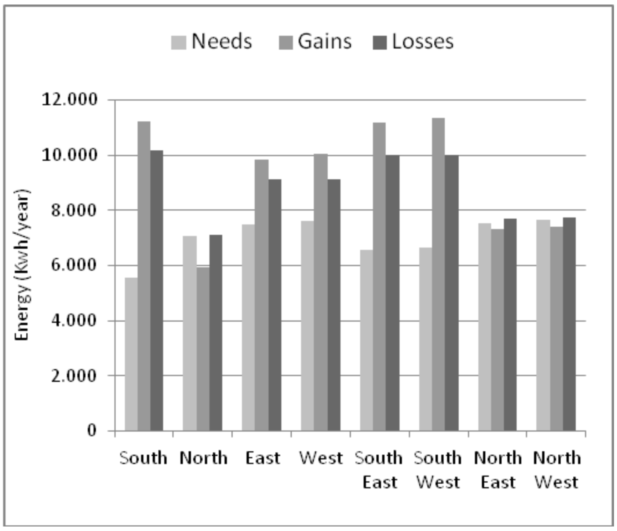

Fig. 10. Annual energy needs, gains and losses

South-West) remain the best choice for less energy consumption in terms of heating and cooling. These same orientations are those that benefit from the largest energy gains, but also those that score the most losses. The data and graphs that follow explain in detail the results obtained for each orientation in terms of energy gain and loss needs.

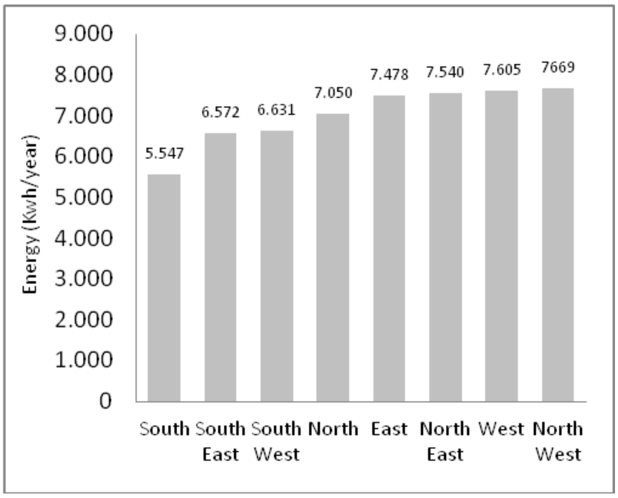

Fig. 11. Annual heating and cooling energy needs

The North is the least consuming energy for cooling (Fig 12) due the fact that it gains less annual energy gains especially solar ones (Fig 15 and 16)

The South is a good orientation in terms of energy saving for cooling; in fact except the North, it is the least energy-consuming orientation. The south orientation is explained in detail in a chapter below.

The East and the West score very significant energy losses for cooling. Indeed, the west is the most energy-consuming orientation in terms of cooling (Fig 12). This can be explained by the curve of the sun in summer, where days (time between sunrise and sunset) are the longest of the year [8], this explains why these orientations receive more solar gain

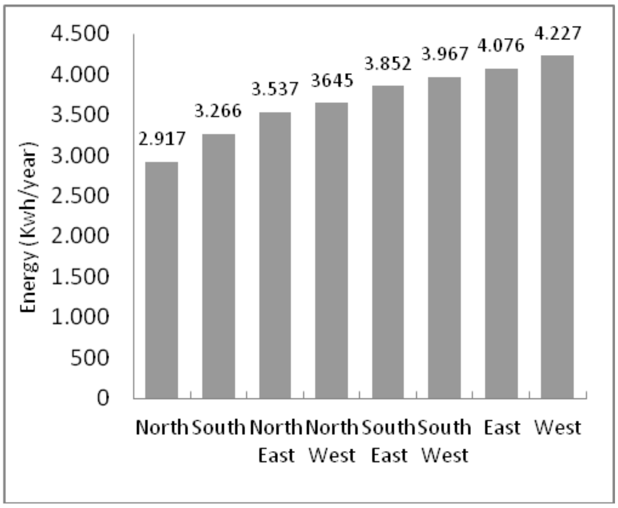

Fig. 12. Annual cooling energy needs

especially during spring and summer months. The graph of the monthly energy gains of the West orientation (Fig 13) inserted here as an example approve these explanation and informs us about the difference between these two orientations (East and West) and the South, which benefits from more solar gains but doesn't consume much more energy for cooling which is explained by the fact that it gains less solar energy during the summer and spring months (April to September) (Fig 27).

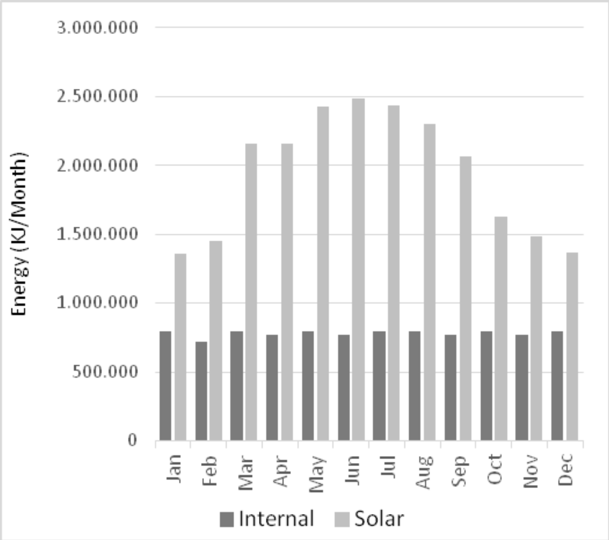

Fig. 13. Monthly solar and internal energy gains for Ouest Orientation

B. In Terms Of Energy Needs For Heating:

The south side orientations (South, South-East and South-West), are the best choices in terms of saving energy for heating (see graph and table) (Fig 14). This can be explained by the fact that they benefit from more solar gains than the other orientations (Fig 15 and Fig 16).

The orientation to the south is the best way to save energy for heating.

The North side orientations (the North, the North-East, and the North-West), as they gain less solar energy (Fig 15 and Fig 16), they mark a high energy consumption in terms of heating. The North is the most heating energy consuming (Fig 14).

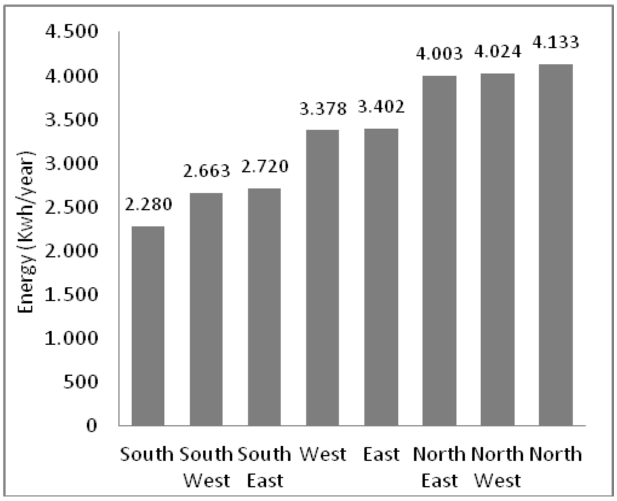

Fig. 14. Annual heating energy needs

East and West, benefit from average solar gains, hence their middling saving in heating (Fig 15).

C. 4.3 In Terms of Energy Gains

The south side orientations (South, South-East and South-West) are the most energy gaining (Fig 15).

The North side orientations (the North, the North-East, and the North-West), do not benefit from sufficient energy gains (Fig 15).

East and West, benefit from average solar gains.

These results are due to the curve of the sun along the day and during the whole year (Fig 15).

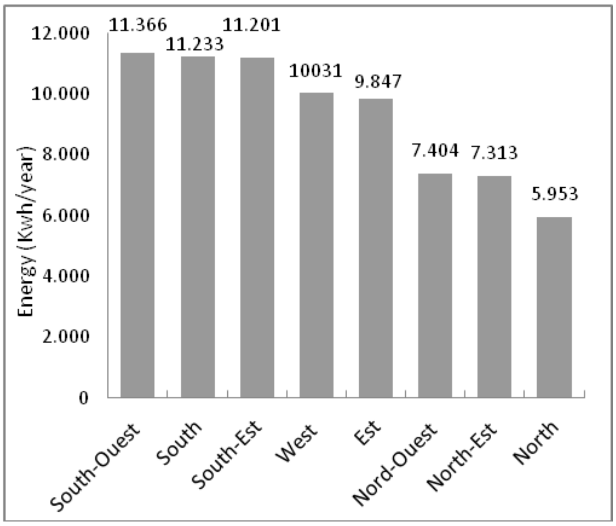

Fig. 15. Annual energy gains

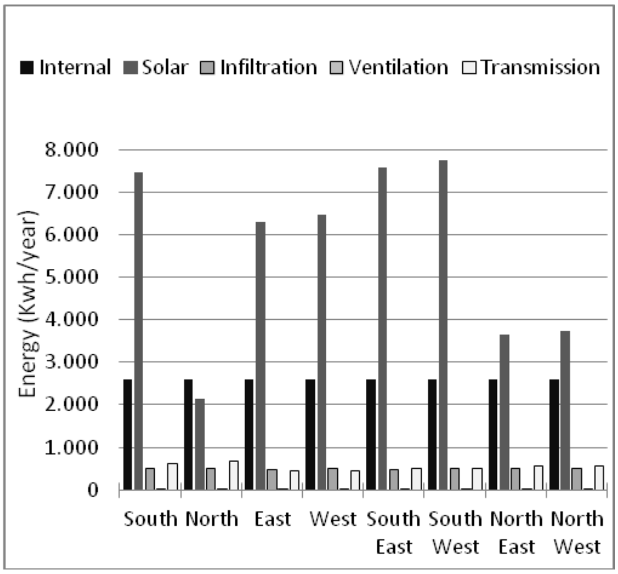

Fig. 16. Partition of annual energy gains

The solar gain differs radically from an orientation to another. The gains due to infiltration, transmission and ventilation in addition to internal gains are almost identical on all orientations, (Fig 16). This is logic due the fact that the simulations occurred on the same dwelling (same technical details and internal systems as explained above.)

In terms of their distributions, for the following orientations (South South East, South West, East and West) solar gains represent more than 60% followed by internal gains (+20%), and finally transmission, infiltration and ventilation gain represent less than 10%. (Fig 17)

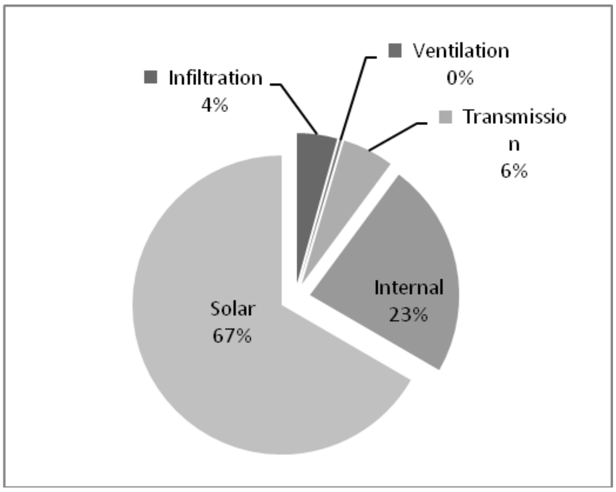

Fig. 17. Distribution of annual energy gains (South orientation)

As for the North side orientations (North, North-East and North-West), the distribution changes, the solar gains do not represent more than 45% and the internal gains become more important (more than 35%). gains by transmission, ventilation and infiltration represent almost 15% with earnings rates varying between 7% for infiltration, 7% for transmission and 1% for ventilation.

The North is the only orientation in which internal gains (+ 40%) are more important than solar gains (+ 30%). (Fig 18)

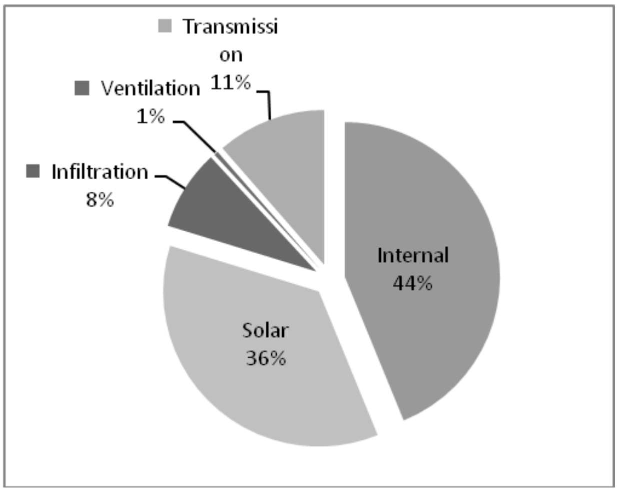

Fig. 18. Distribution of annual energy gains (North orientation)

D. In Terms of Energy Losses

South side orientations (south, south-east and south-west) lose a greater quantity of energy than the other orientations as they gain great amounts of solar energy. (Fig 19)

The North side orientations (North, North-East and North-West) show less energy losses as they receive less solar energy gains.

The North remains the orientation which marks least energy losses and South the most ones (Fig 19)

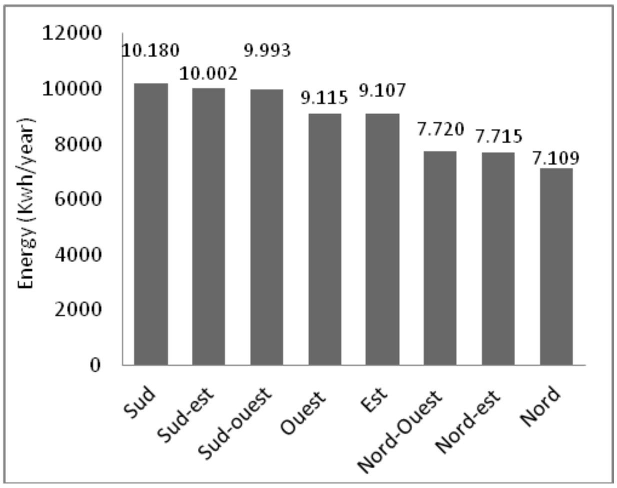

Fig. 19. Annual energy losses

As for the causes of the energy losses, we observe on the Figure 20 below that, on all the orientations, the losses by transmission represent the major part (+ 85%), those by infiltration represent (+10%), as for the losses by ventilation they are very minimal (less than 2%).

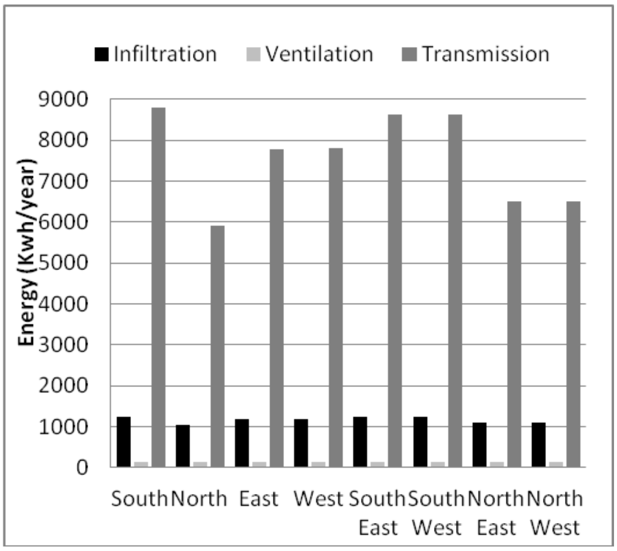

Fig. 20. Distribution of Annual energy losses

VII. EXHAUSTIVE RESULTS (CASE OF SOUTH ORIENTATION)

A. The Less Energy Consuming Orientation

The South is the orientation that marks energy savings in terms of cooling and heating needs. In order to understand the interest of this orientation facing its energy savings, we present below a summary of the results of the simulations obtained for the South orientation.

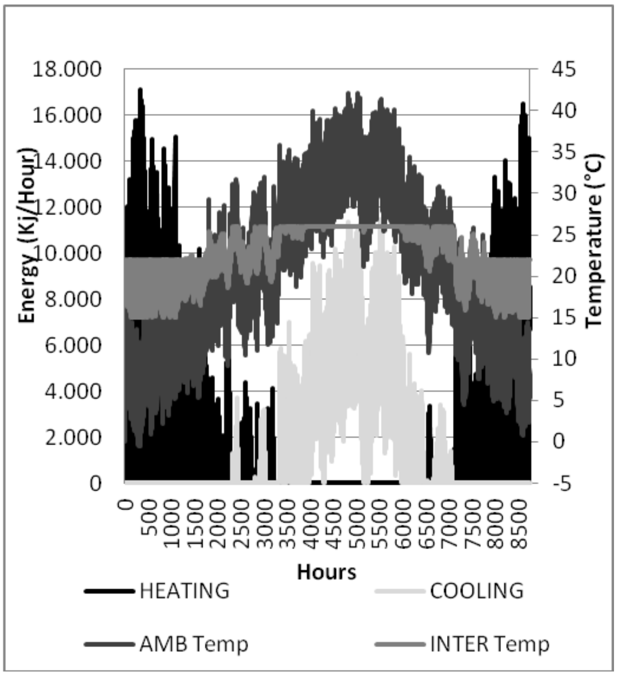

Fig. 21. Hourly heating and cooling energy needs in relation with ambient and interior temperature (case of South Orientation)

B. 5.2 Results in Terms of Energy Needs

The orientation of the main facade to the south remains the best choice and the best solution in terms of energy consumption, (5547 KWH / year equivalent to 92 Kwh/m2 /year with a consumption of 38 Kwh/m2/year for heating and 54 Kwh/m2/year for cooling (Fig 22 and Fig 10).

In terms of heating: the south is the least energy-consuming orientation, as it gains much more solar energy.

Heating is active in 7 months (Fig 24)(from October to May) and it achieves significant energy consumptions in November, December, January and February, since the outside temperatures realize significant drops (see the equivalence of the before mentioned months in hours in Figure 21 (from 7296 hr to 8760 hr and from 0hr to 1416 HR)).

The month in which there is more energy consumption in terms of heating, is January (fig 24) with a total consumption of 716 Kwh, as the outside temperature goes down by 0 ° (Fig 21), followed by December with 634 Kwh, February (439 Kwh) and March (129 Kwh). (Fig 24)

Consumption in the months of April (37 Kwh) May (16 Kwh) and October (47 Kwh) is not significant, as the outside temperature is not yet drastically reduced.

Cooling represents 59% of annual energy needs, while heating it represents 41% (Fig 23)

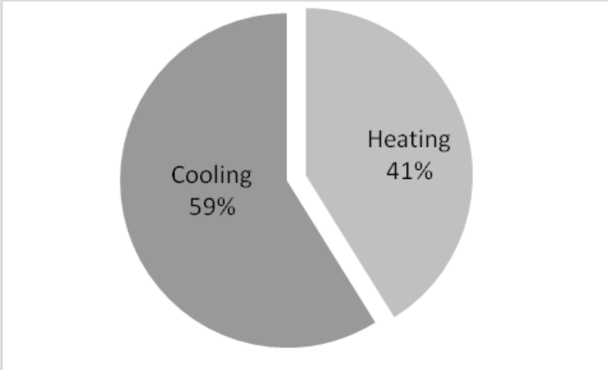

Fig. 22. Distribution of annual cooling and heating needs. (case of South Orientation)

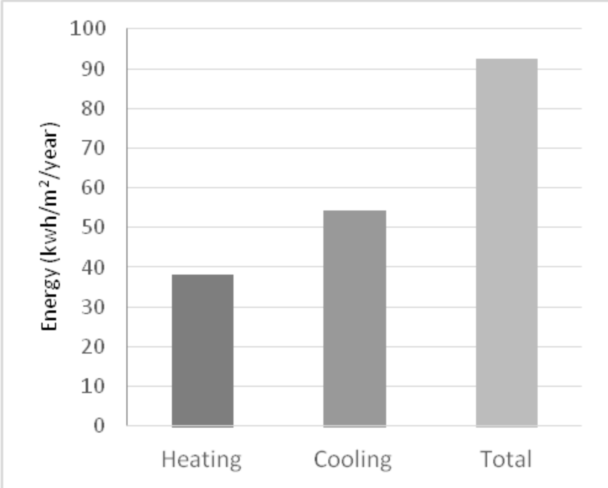

Fig. 23. Annual Cooling and Heating needs per m2 (case of South orientation)

In terms of cooling: the orientation to the south is also a good decision in terms of cooling energy saving. As we explained before it is due to the fact that it receives less solar energy gains in summer (Fig 27) due to the course of the sun in summer.

The cooling is active in a total of 7 months (from April to October) (fig 24). As the outside temperature becomes more important, cooling becomes significant by May, with a total consumption of (171 Kwh) June (532 Kwh), July (1125 Kwh), August (925 Kwh) and September (381 Kwh), (see the equivalence of the before mentioned months in hours in Fig 21 (from 2880 hr (early May) to 6552 hr (end of September)).

The month that shows more energy consumption in terms of cooling is July, during which the outside temperature exceeds the 40 °C (Fig 21), followed by the month of August. (Fig 24)

The total energy consumption at the level of April (16 Kwh) and October (46 Kwh) remains less important due to the fact that the outside temperature is not yet so hot.

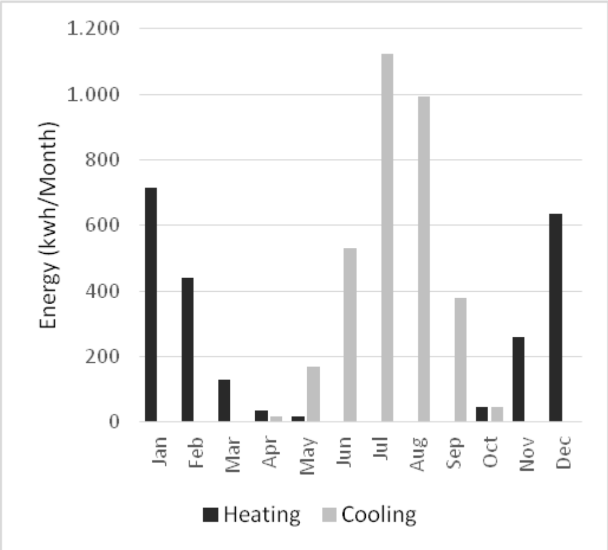

Fig. 24. Monthly cooling and heating energy needs (case of South orientation)

C. Results in Terms of Energy Gains

The south is the orientation that realizes the most energy gains (Fig 15).

Solar gains represent more than 67% of energy gains, which are equivalent to a total consumption of around 7486 Kwh, followed by internal gains (23%) (2608Kwh). the gains by transmission, infiltration and ventilation respectively represent (6%, 4% and less than 1%) equivalent respectively to 626 Kwh, 487 Kwh and 26 Kwh (Fig 25 and Fig 26).

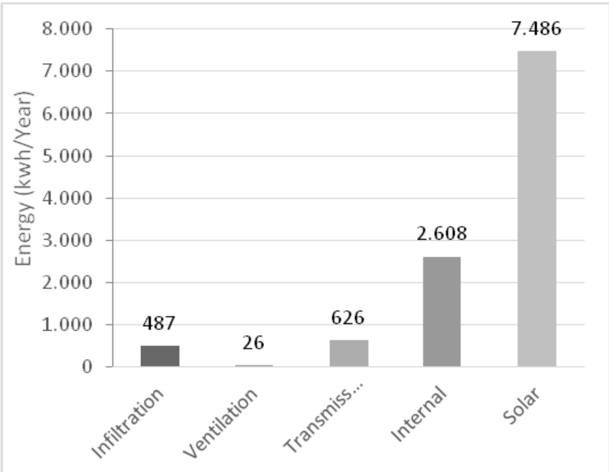

Fig. 25. Annual solar and internal energy gains. (case of South orientation)

The solar gains are realized during all the months of the year, they become more important in autumn and winter, between September and March, they go down in spring and summer (between April and August) (Fig 27)

The most important solar gains are realized in the month of January (1005Kwh), and November and the least important in the month of June (244 Kwh) (Fig 27)

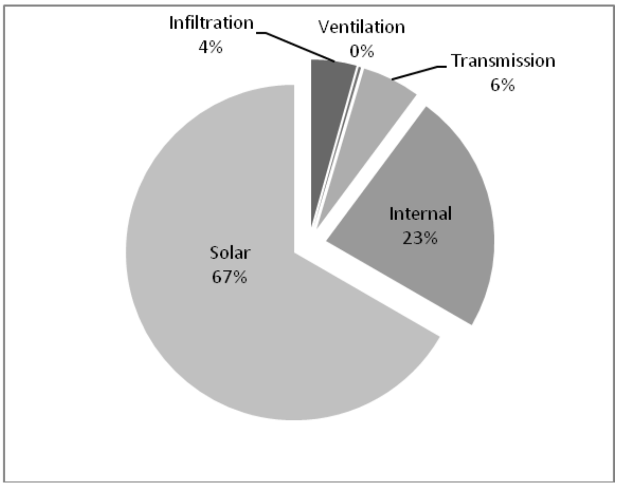

Fig. 26. Distribution of annual energy gains in case of South orientation

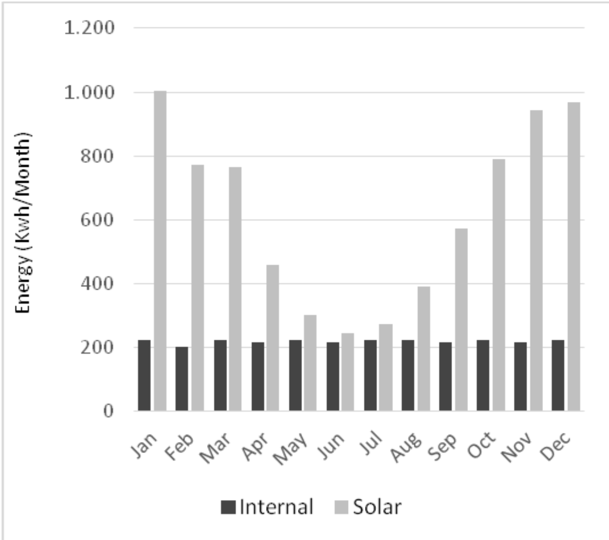

Fig. 27. Monthly solar and internal energy gains (Kwh/month). (case of South orientation)

D. Results in Terms of Energy Losses

As it gains the great amount of solar energy, the south, is the orientation that realizes the most energy losses (Fig 19)

The common part of the energy losses are realized by transmission effect (86% of the energy losses which are equivalent to 1249 Kwh/year), followed by infiltration (12%) equivalent to 1249 Kwh/year), and finally by ventilation which remain insignificant (2%) equivalent to 142 Kwh/year). (Fig 29 and Fig 30)

The months of January and December are those which realize the most energy losses. (Fig 30)

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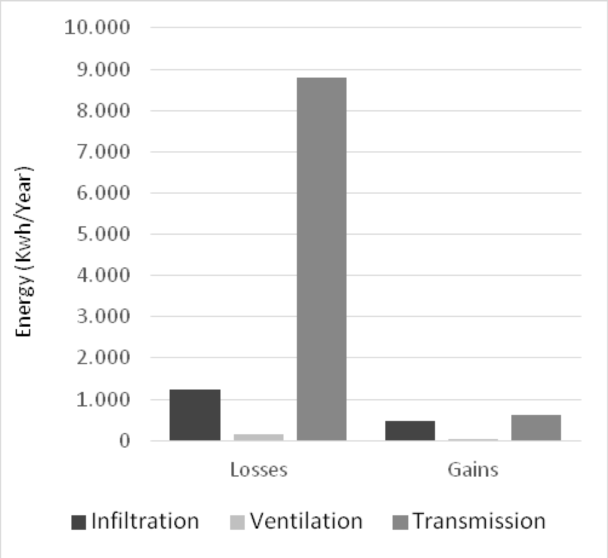

Fig. 28. Annual energy looses and gains due to infiltration, ventilation and transmission. (case of South orientation)

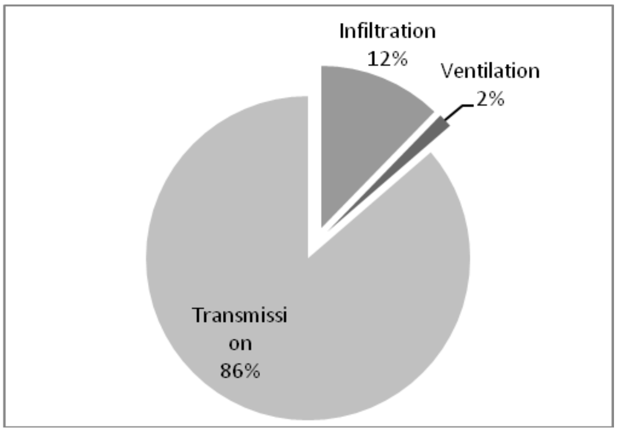

Fig. 29. Percentage of annual energy losses due to infiltration transmission and ventilation. (case of South orientation)

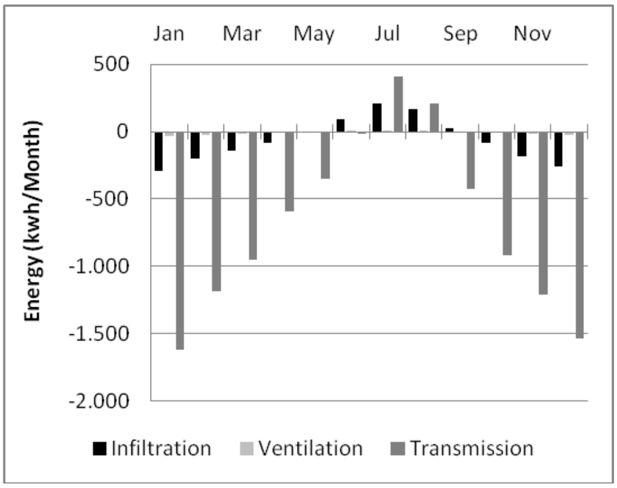

Fig. 30. Monthly energy looses and gains due to infiltration, ventilation and transmission. (case of South orientation)

It is so important to indicate that the effects of transmission, infiltration and ventilation, also contribute to energy gains that occur in the summer period (between June and September) but which remain negligible (10%) in comparison with the losses that it generates (90%) (Fig 31)

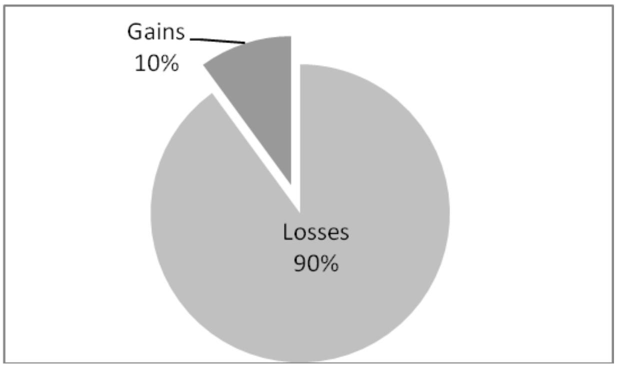

Fig. 31. Percentage of annual energy gains and losses due to infiltration transmission and ventilation. (case of South orientation)

VIII. CONCLUSION

In this study, we carried out simulations to study and analyze several orientation variants in terms of their needs, their energy gains and losses, in order to determine the orientation or orientations the most adequate in terms of energy consumption in a desert climate of the city of Errachidia.

At the end of the analysis of the results of this study, the following conclusions are drawn:

In general:

- The orientation has a significant impact on the energy consumption of heating and cooling and thus the annual energy bill.
- Orientations on the south side (South, South-East South-West) are the least energy-consuming;
- Orientations on the North side (North, North-East and North-west are more energy consuming;
- the South remains the best choice in terms of saving energy, since it makes the best balance between energy gains and losses;
- The Northwest orientation is a bad choice, as it marks the most energy loss between all other orientations.

In terms of cooling:

- The North is the least energy-consuming orientation in terms of energy needs for cooling, as it receives the least solar gains and has the lowest energy losses;
- The West and East are respectively the most energy-consuming in terms of cooling because they receive more solar gains in summer;

In terms of heating:

- The south is the least energy-consuming orientation, as it benefits from more solar gains in winter;
- The North remains the most energy-consuming, as it receives the least solar gains throughout the year.

These results illustrate the importance of the orientation in energy savings in terms of heating and cooling.

We expect that these results will participate to reach objectives of the new energy strategy - 2030 drawn up by Morocco in terms of the contribution of renewable energies in electricity production and therefore reduce the greenhouse gases, preserve the natural resources and also reduce of the annual energy bill for citizens.

Finally, we hope that these results will push architects, building owners and governments around the world to take seriously into consideration the orientation and the design of climate responsive building envelopes.

REFERENCES

1. International Energy Agency, "Energy Policies Beyond IEA Countries - Morocco 2014", 10 October 2014, 132 Pages, ISBN PDF: 978-92-64-21148-3, All rights reserved.
2. International Energy Agency, "Energy Policies Beyond IEA Countries - Morocco 2019", 7 Mai 2019, 158 Pages, ISBN PDF: 978-92-64-21148-3, All rights reserved.
3. International Energy Agency, The United Nations Environment Programme (2018), The Global Alliance for Buildings and Construction (GlobalABC). "2018 Global Status Report: Towards a zero-emission, efficient and resilient buildings and construction sector", 2018, ISBN No: 978-92-807-3729-5, Copyright © United Nations Environment Programme, 2018.
4. Agence Nationale Pour le Développement des Energies Renouvelables Et De L'efficacité Energétique « Les bonnes pratiques de l'Efficacité Énergétique dans le bâtiment»
5. The Solar Energy Laboratory, University of Wisconsin-Madison "Trnsys 16 a Transient System Simulation Program, Volume 1 Getting Started", 2007.
6. Meteotest: Jan Remund, Stefan Müller, Stefan Kunz and Christoph Schilter "Meteonorm: Global Meteorological Database" Handbook Part I, Software Version 7/ May 2012"©Meteotest.
7. Services of Windfinder.com GmbH & Co. KG. Version: 2019-03-13, https://fr.windfinder.com/windstatistics/errachidia_moulay_ali_cherif. 2019
8. Benoit Beckers, "Le Diagramme Solaire" 2004, http://www.heliodon.net/downloads/Beckers_2004_Ir_Le_diagramme_solaire.pdf.

AUTHORS PROFILE

Omar Bourass, Morocco, 1986, Architect and Urbanist, he is a principal Architect and a Head of Service of Urban Observation Phenomena in the Direction of Urban planning in the Department of Land, Urban Planning and Housing in Morocco. He is an expert in the urban planning field. He got an Architecture degree, a Master degree in sustainable transport and urban mobility, and he would defend soon his Doctorate thesis about the energy efficiency in the building.

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From 2000 to 2019 he has many responsibilities, he was director in charge of Scientific Research and Cooperation at EST-Salé, University Mohammed V (2014-16), he is an expert member of the National Agency for the Quality Assessment of Higher Education and Scientific Research (since 2015), he was manager of the Continuing Education Service (2008-2014), he was Chief of Industrial Maintenance Department (2000 to 2008), he was Coordinator of the "Industrial Maintenance" DUT program (2006-2010), he was Coordinator of the Master's degree program "Management and Consulting in Information Systems" (2007-2014)….

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Pr. Aziz Et-tahir was awarded by the International Association of University Pedagogy (AIPU International) at the 25th International Congress of the AIPU, Montpellier-France, 19-22 May 2008 and at the 28th International Congress of the AIPU, Mons-Belgium, 17-23 May 2014. About professional associations, he was Vice-President (2012-18 appointed in Canada) and member of the International Board of Directors (2009-2018) of the International Association of University Pedagogy (AIPU International), he was a founding member of the Moroccan Society of Acoustics (SCA) (2010), he was (since 2000) founding member and member of the Board of Directors of the Moroccan-French Association of Energy and the Environment (AMFREE), (since 2006).
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