Department of Architecture. University of Biskra

Laboratory of Architecture & Environmental Design (LaCoMoFa)

Solar energy and urban form. New ways of modeling sustainable urban fabric in the Mediterranean region.

Research Scope

Objectives

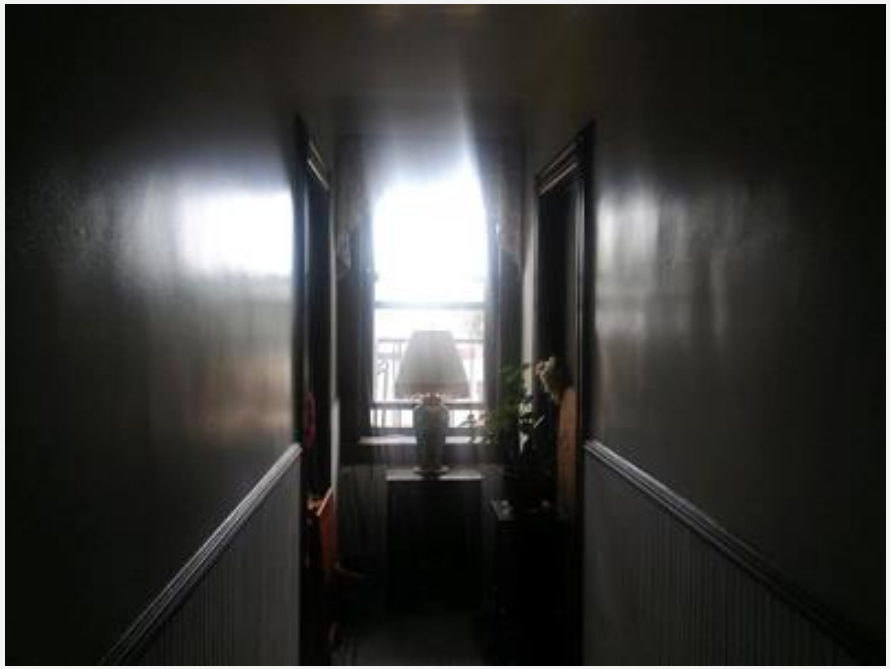
Methodology & Case study

Tools

Results and interpretations

PROBLEMS AND ISSUES

- In the urban environment, Important surfaces of building's envelope are shaded;
- Lack of natural lighting.



Interior daylight problem

BOUAKAL district – BATNA city [Google earth]

PARADOX

- Paradoxically, Algeria has a very large solar field, due to its privilege location;

Climatic region	Littoral	Highlands	Desert
Sunlight (h/year)	2650	3000	3500
Energie received (KWh/m2/year)	1700	1900	2650

Sunlight received annually in Algeria by region

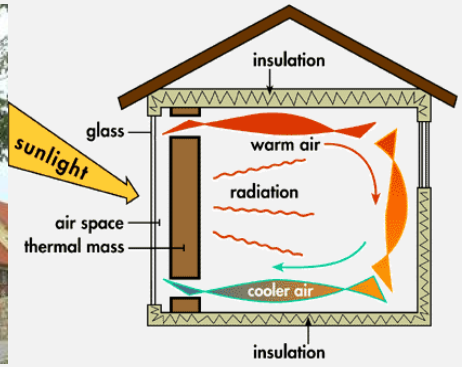
Energy received
169400 TWh/year

5000 Times

consumption

- Exceptional opportunities are available to exploit this huge energy potential

Active heating

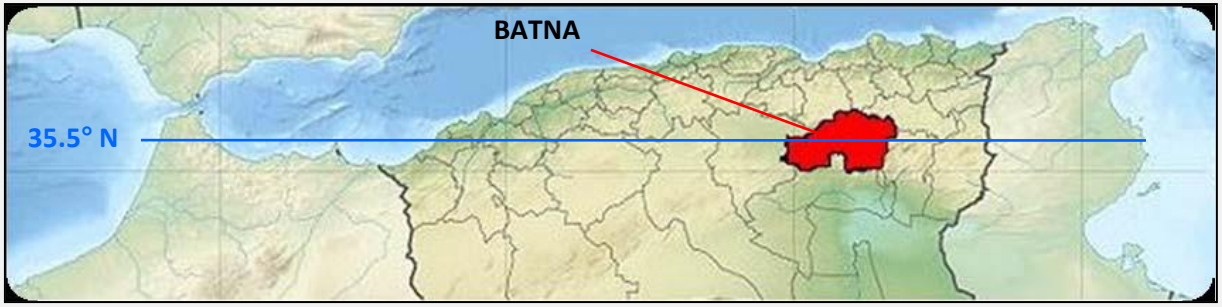


Passive heating

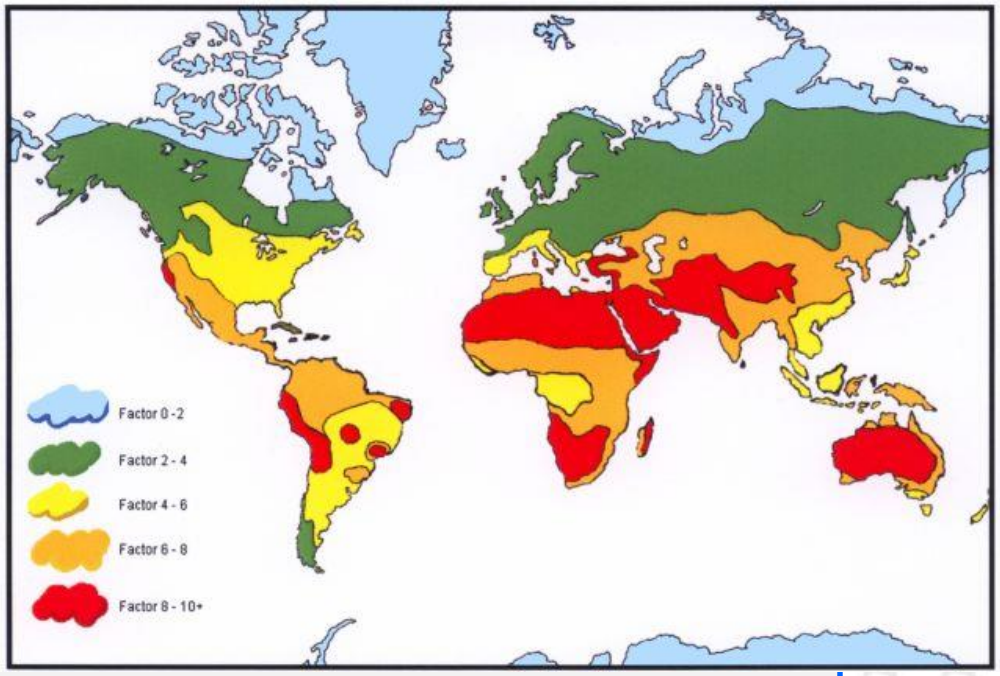
Photovoltaic

Daylighting

CASE STUDY



Geographical location of the study zone

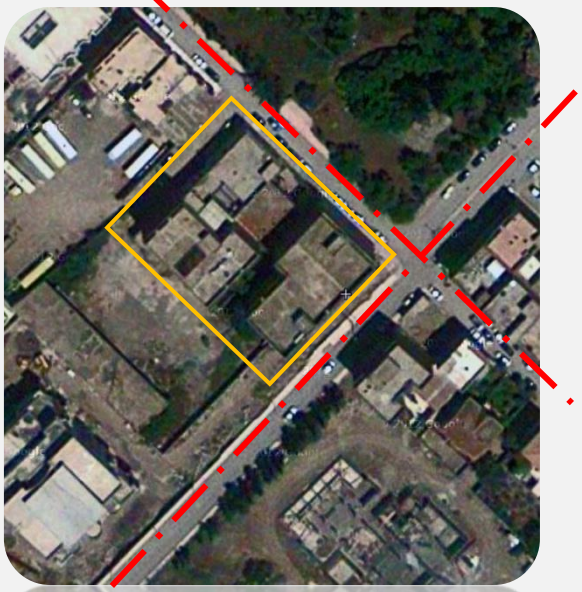


World map of main annual Sunniness values.
Source : [online] URL : http://anjoumadagascar.free.fr/projet_solaire.ht

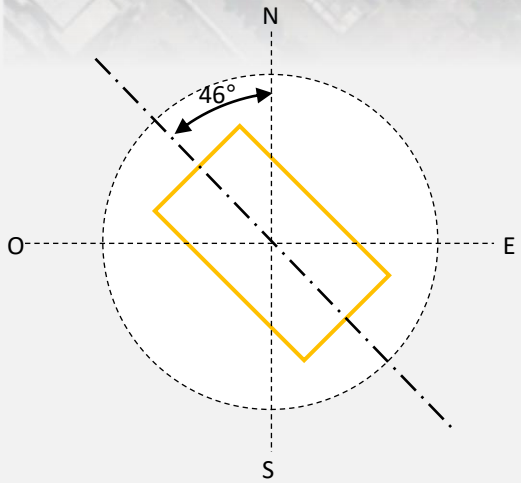
Monthly frequencies sky condition of BATNA city, based on main percentage of 22 years (Jul 1983 - June 2005).
Source: [online] URL : http://eosweb.larc.nasa.gov/sse

Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
0	0	0	0	0	0	0	0	0	0
30.30	29.37	30.79	43.41	61.11	50.42	32.88	24.78	23.48	26.20
14.71	18.95	20.46	20.57	20.46	23.40	24.24	25.61	24.49	22.87
52.59	52.57	54.99	51.69	48.75	36.02	18.44	26.18	42.88	49.61	52.02	50.83

CASE STUDY



- City center
- Administrative
- 2450 ,65 m2
- 2-3 stories block



	façades				roofs
Orientation	S-E	S-W	N-W	N-E	
area (m2)	1015.26	738.34	961.88	806.99	1660,17
Faces Occupation (%)	**28.82**	20.96	27.31	22.91	

METHODOLOGY

EVALUATION

Methodology

- **Location & sky conditions**

-SSE Program (Surface meteorology and Solar Energy) -NASA-

- **Site digital model**

- AutoCad
- SketchUp

- **Computer simulation**

- Solene

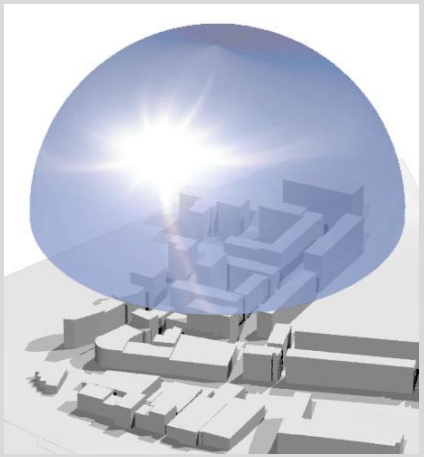
- **Performance indicators**

- Excel

1. Calculate thresholds
2. Calculate the cumulative irradiation & illuminance distributions
3. Calculate the potentials for solar techniques

[Final Energy]
=
[Urban Solar and Daylight Availability]
⊗
[Utilization Factors]

[Urban Solar and Daylight Availability]
=
[Sky]
⊗
[Urban form]



CONCLUSION

The study purposes were:

1. **Evaluation of solar performances of the new administrative district of BATNA city**
2. **Optimization of this urban form for a best utilization of solar energy**

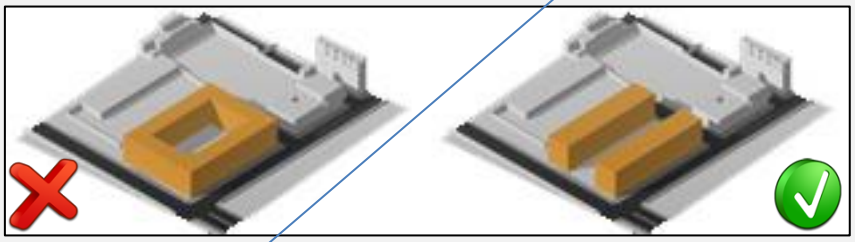
✓ Results obtained can help designers to choose the appropriate location of the different solar technologies.

✓ It were be possible to demonstrate that existing envelope is strongly appropriate to solar thermal collectors

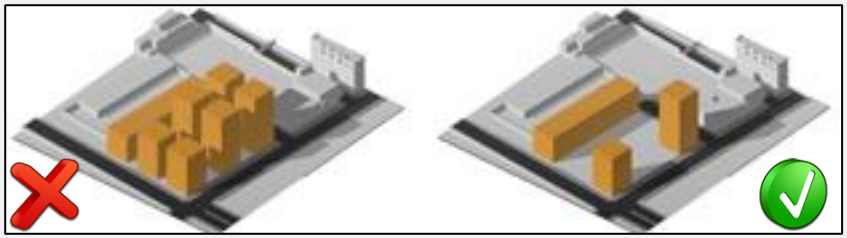
✓ Façades oriented to North, North-east, & North-west directions couldn't recover Heat loss in passive way during winter.

CONCLUSION

RECOMMENDATIONS FOR DESIGNERS

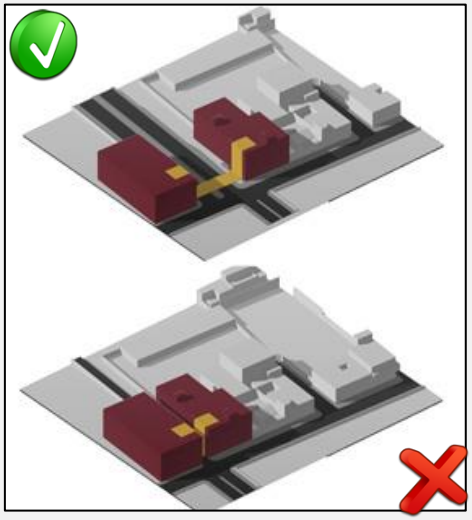


Buildings form

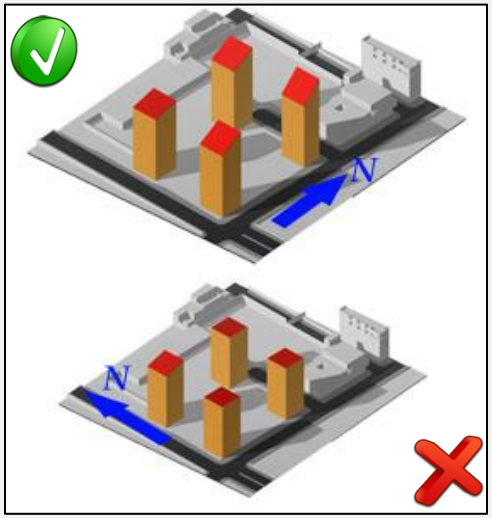


Density

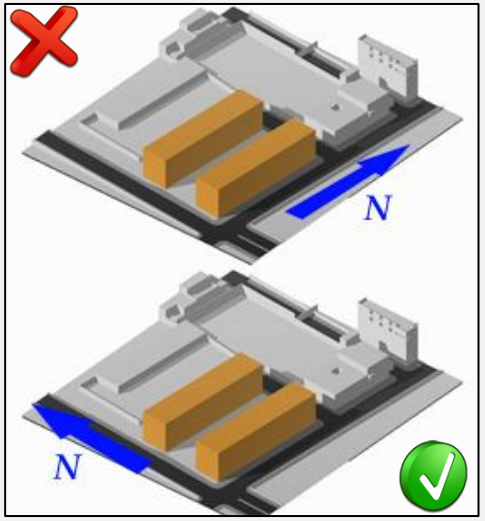
H/W



Roofs



Orientation



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Thank you for your attention