A Cultural Center in Tel Aviv-Jaffa, Israel
A Green gathering
Design of a Bioclimatic Architectural project

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My project is a cultural center that will serve the population of the city of Tel Aviv-Jaffa and the surrounding area. The project will be built according to the bioclimatic design guidelines and will promote and educate people to live in environmental sustainability, by doing activities and spreading out knowledge. The idea of this kind of project was established as a direct response to the pressing need for greater knowledge on environmental issues. It promotes new areas of environmental activities, environmental teaching programs for kids and young adults and places environmental issues on the day-by-day public agenda. The idea is to live in comfortable and pleasant spaces, but with less energy consumption. This goal is set in the world today as ZERO ENERGY, energy equalization.

INTRODUCTION

The idea is to create a change in the way of thinking: To promote sustainability within the community by talking about the importance of energy saving strategies and to live differently. By having a common problem and a common interest, a dialogue can be achieved. The project goal is to use common place/land, using the green methods and to build a sustainable building that will encourage green education.

A change is essential, especially in the city of Jaffa, where there is a huge gap and intense arguments between the city's inhabitants: the Jewish community and the Arab community. The literal assumption is to take a common problem, like the environmental problem and to bring a common solution and common interests.

A BIOCLIMATIC PROJECT IN ISRAEL

Human kind should in overall make efforts to stop the Greenhouse effect. We have a responsibility to reduce greenhouse gas emissions into the atmosphere in the coming years. In this context, the reason for choosing Jaffa can be seen from different approaches. **T**he government of Israel set a target of 10% of energy consumption from renewable resources by 2020. There are many efforts to encourage projects with ZERO ENERGY and also to increase the awareness among the inhabitants. Israel has a very high sun radiation (i.e. sun hours), so that it is very appropriate for sun powered energy generation. In the other hand, that specific location in Jaffa-Tel Aviv, is important for a project (MIDRON project) that is also a green sustainability project. It uses a neglected area that was used as a disposal site, and turned it into a park for the welfare if its town residents. The waste was sorted and some of it was used for establishing the park. This green approach will serve the city.

Israel is a country located on the eastern shore of the Mediterranean Sea. Tel Aviv-Jaffa is the second most populate city in Israel. Situated on the Israeli Mediterranean coastline. In Jaffa section: Approx. 46,000 habitants in Jaffa (11.4% from whole of Tel Aviv. Approx. 30,000 Jews and Approx. 16,000 Arabs. Geographical data: Lat. 32° 4' 0N Long. 34° 46' 0E Altitude 34m (114 feet) UTC/GMT (Greenwich T.) +2

Figure 1: A general view of Jaffa. Source: TAZPIT views

DESIGNING THE PROJECT

The methodology used for the project has to deal with the exhaustive analisis of previous **physic** and cultural conditions related to the place and location.
First of all an urban analisis is defined .The area has few different facilities: houses, public areas, parks (open spaces) and a commercial area. There is a continuation from the urban sector to the center of the city. The main roads (YEFET and JERUSALEM Ave.) are going all the way up to the center of the city. The MIDRON Park
is a major facility in that urban area as well as the sea from the west. My project is in the center of that city analysis. I suggest the integration of the residential area with the public area, in order to create a more vivid and dynamic area.
The analysis of the cultural and dynamic activities of the area is important because my project intents to enrich the offer of cultural and dynamic activities, thus making it more special and unique and attracting more people to the site, since most societies share many traits in common: cultural and dynamic activities.
The old city: The Old Jaffa area is the area where the city of Jaffa was located throughout history. Old Jaffa is now referred as the area surrounded by walls during the 19th century. The complex is located at the top of the gravel hill of Jaffa.

MICRO CLIMATIC DATA
Solar route Solstice in Tel Aviv-Jaffa
This figure is the result of our geographical location:

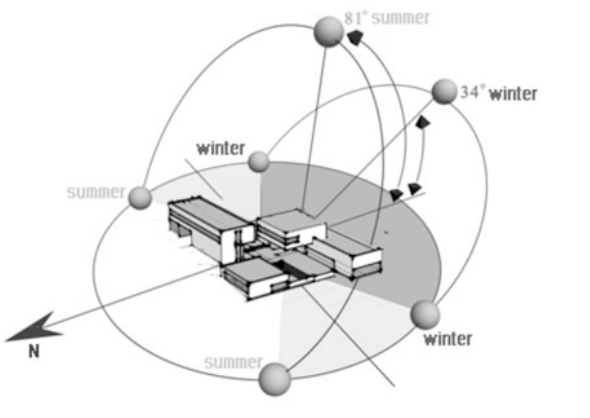

Figure 2: Inclination of Sun´s Rays in different seasons. Source: Own work.

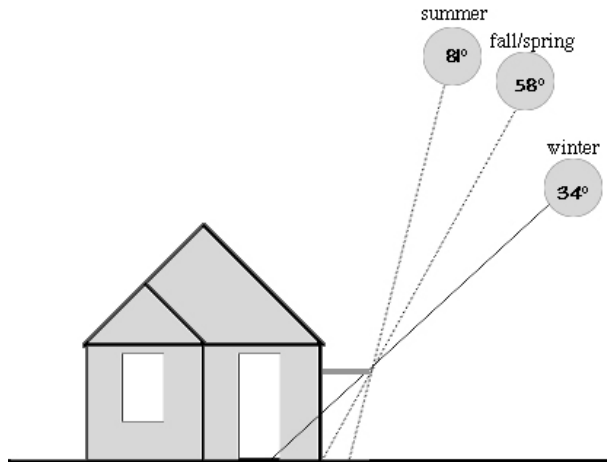

Figure 3: Solar path solstice in TEL AVIV-JAFFA during winter and summer. Source: Own work.

Tel Aviv has a Mediterranean climate with hot, humid summers, unpredictable springs and autumns, and cool, rainy winters. The fall and spring are transition periods between winter and summer.

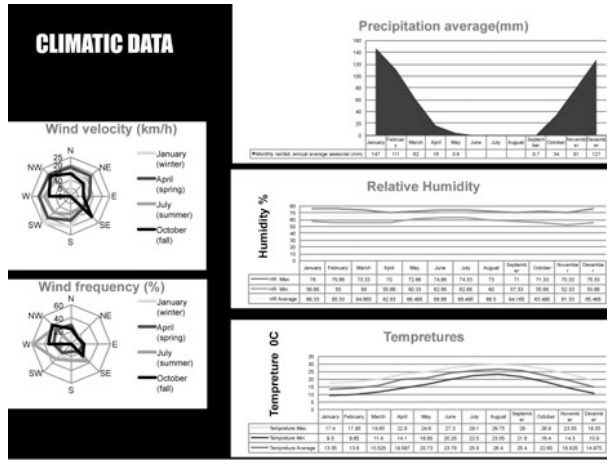

Figure 4: Climatic data summary. Source: Own work.

The following phase is the implementation of the data and the Bio climatically research, on the site. Examine the data on the site allow us to take architectural and designing decision, such as: orientation, opening location, materials, design elements on the façade itself, etc. But the major decision is the Bio climatically strategy.

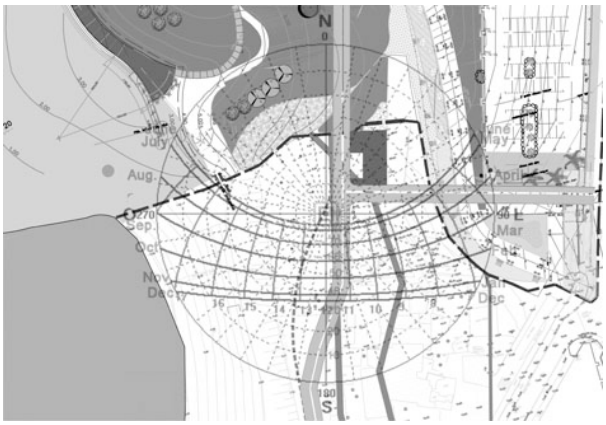

Figure 5 Graphical analysis and implementation on the site

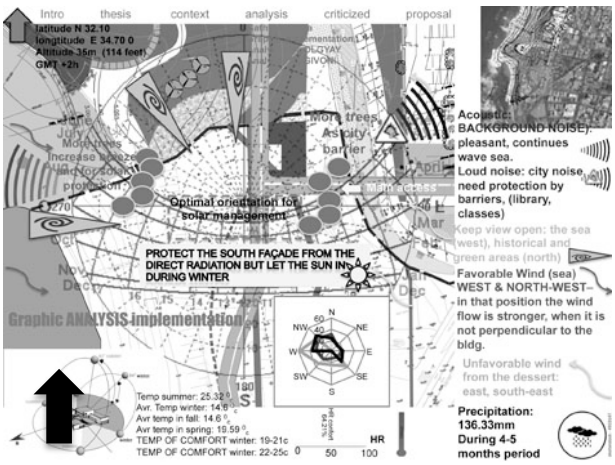

Figure 6: Implementation on the site. Source: Own work.

Parameters that were exanimate: Acoustic: background noise): pleasant, continues wave sea. Loud noise: city noise, need protection by barriers, (library, classes). Keep view open: the sea (west), historical and green areas (north). Favorable Wind (sea) WEST & NORTH-WEST– in that position the wind flow is stronger, when it is not perpendicular to the bldg. Unfavorable wind from the dessert: east, south-east.

SUSTAINABILITY DESIGN GUIDELINES

1. Orientation – chosen orientation: EAST – WEST.

The east west Façade should be smaller in order to eliminate the exposure. Orientation - We want to achieve a passive solar house. This concept means to have a building "working for us" according to the local climate. The house will "function" according to this concept both in summer and winter: keep it cool during warm days and warmer during the winter. This type of structure will allow a thermal comfort indoor with a minimum of energy input. During the wintertime, the goal is to use solar energy of the sun to heat the house. According to the sun path in Israel, we can see that in winter the sun goes through the south, in a lower path and provides a good access/diffusion of sunlight into the house. During the summer, the sun goes in a higher angle. The design of the appropriate size of openings in the Façades and evaluating the appropriate shading elements will prevent the access of direct sunlight.

2. Heat gain in winter

The idea is to "capture radiation" in winter in order to use the solar energy for heating. This process will occur by allowing the sun into the house directly, through the south windows, and warm the house. We use this heat to reduce energy consumption.

3. Solar Protection:

In the four Façades: north, south, east and west. According to our analysis, we will consider the two most extremes dates: winter and summer (June and December). And make sure that windows are protected from the south March 21 to 21 September. (According to the research we have made, the solar elevation angle, is 58 ° and above).

Shades: We will have to calculate the angle of the sun and provide the appropriate shading for the opening, in a way that we will have enough heat to have a comfort space and natural light yet, to avoid overheating. Shading is a very important issue in the energy-saving strategy. It can be divided into three shading modes: fixed, partially reversible or dynamic. Each of them can be applied horizontally, vertically or angled.Windows overhangs (designed for this latitude) or poperable sunshades (extend in summer, retract in winter).

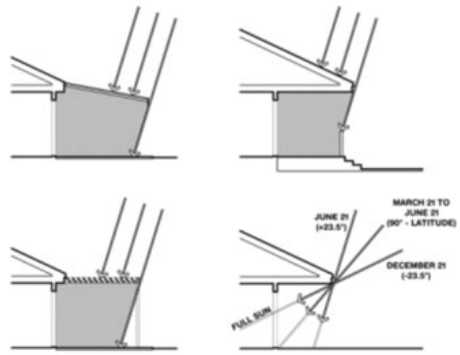

Figure 7: Shading strategies. Source: http://windows.lbl.gov

4. Thermal inertia

Passive solar radiation and energy saving. The idea is to achieve a balance in the thermal mass insulation. This allows not only heat in the winter but also some support for home cooling in summer. The solar heat stored during the thermal mass in winter sunrise hours,

then released slowly into the structure and balances the cold from the nighttime temperatures. Summer: The thermal mass cools the space. When temperatures get high during the hot summer days, the heat "escapes" slowly (non-scientific idea) due to the thermal mass and the isolations materials.

5. Cross ventilation

Natural crossed ventilation is an excellent way to improve thermal comfort in the structure. When air moves, we may stay in its relatively high temperature and feel comfortable, compared to the same temperature space with no wind. For natural ventilation to occur there must be a pressure difference between the entrance and the exit. The location of the air entrance opening affects airflow patterns more than the location of the outlet.

6. Materials and colors

It is important select the correct materials that will be superior to the project with the right thermal mass and insulation and bright colors. Taking into consideration the building climate and energy savings. Using as many as possible - recycling construction materials and natural materials. Using forms and traditional aesthetic elements in the building envelope that will suits the climatic environment.

7. Natural light

Sunlight linked in our minds with clarity, joy, warmth and health. Many studies conducted around the world about the importance of natural lighting and optimal functioning for the welfare of users in buildings, and by all, energy consumption.

DESIGN GUIDELINES IDEAS

Practical and easy accessibility to the project in order to emphasis the gathering and the connection to the city. Create an outdoor open space in order to allow the people to gather all in one space. Reinforce the water: the sea and the city are mutual for everyone. Keep an open link between the city and the sea. General concept: Integrate with the nature and the location: the city, the green corridor and the sea. The architecture expresses the function: simple lines, response to climate, ventilation and natural light, open courtyards protected from radiation and unpleasant

BIOCLIMATIC DESIGN

1) Implementation

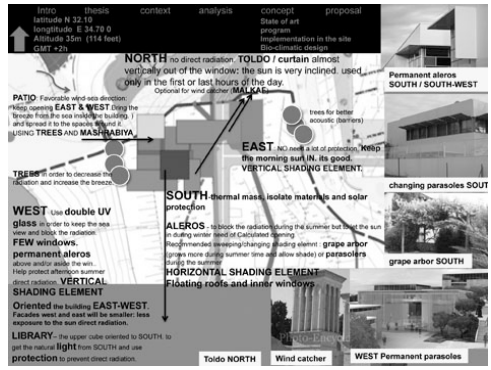

Figure 8: Implementation on site. Source: Own work.

This region is influenced by the Mediterranean sea: a moderate, climate, the temperature influence and merges – temperature variation is small and high humid all year long

Jaffa Port is considered one of the world's oldest ports

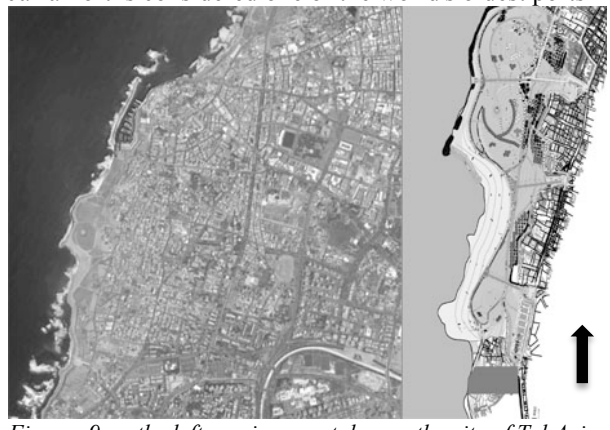

Figure: 9 on the left: environmental map, the city of Tel Aviv-Jaffa by the Mediterranean Sea and the PORT OF Jaffa. On the right: the site of the project. South of Jaffa.

SOCIAL / CLIMATE / CULTURE – PLANS

Guideline:

1) Brings the breeze from the sea inside the building
2) Functions as a bridge from the city to the sea
3) Minimize EAST & WEST facades (oriented north-south).
4) Each function is individual. So it gets light and breeze independently.
5) Library – will get the light from the north. Is elevated. It is the knowledge point and it is important also in its design. It is connected to the historical port of Jaffa.

Brings the breeze from the sea inside the building. Functions as a bridge from the city to the sea. Minimize EAST & WEST facades (oriented north-south). The GREEN boulevard. That goes from Tel Aviv and the north part of Jaffa all the way to Jaffa port. Connect the MIDRON project to my project. The PLAZA: gathering space that invites the people to

activities (can be post on the auditorium wall) and a siting area. From the lower level, there is the entrance to the underground auditorium.

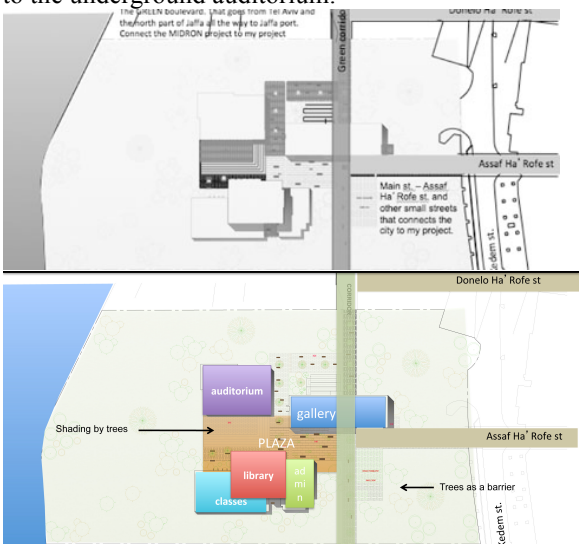

Figure 10: general plan and facilities plan

Floor plan - Venturi effect to accelerate the flow and the air circulation. To maximize the wind flow in the whole space:

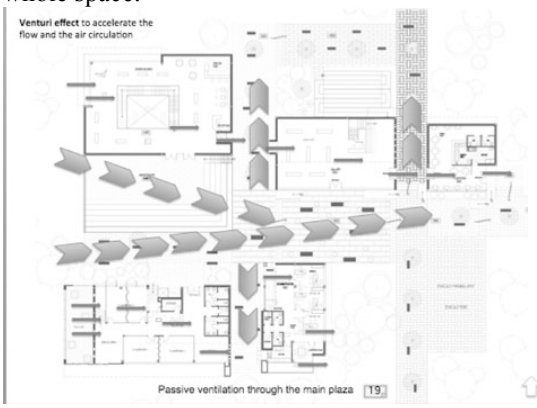

Figure 11: Passive ventilation through the main plan

Bio climatically elements shown in the facades:
Inner windows, floating rooftop, wind catcher.
A sided type of window with a "shelve of light" to extend the natural light. Screened porches/balconies can provide comfort cooling by ventilation
"SAWTOOTH" windows to enter natural light facing SOUTH
Changing shaded blinds (persianas) ocean view
Shaded horizontal elements above windows.
In the south façade: south façade: we wish to enter sun in the winter and block it in the summer. External wall with grape arbor. Floating roof top. changing shaded blinds (persianas). Inner windows. Shaded horizontal element

Figure 13: Bio Climatically Section

Large overhangs and shaded elements combine to limit heat gain during the summer and allowing the sun into the interior during the winter.

THERMAL BALANCE CALCULATION CONCLUSION

I choose the use of concrete and the traditional construction system instead of the light construction system (it means wood), using materials with a high thermal mass, including thermal inertia and isolation and pre-fabricated blocks. I will use natural stones for the exterior spaces. The concrete is produced in Israel. It does not need transportation. According to the point system of "LEED" Green Construction Standard, a high priority is given to materials which only need minimal transportation. The use of wood requires a kind of certified wood which is considered as a green product. In regards to LCA, there is a need for transpiration in the environment. It is not produced in Israel. In the light of the construction system (wood or Steel), the envelope wall has not a thermal mass which could be considered as a problem in this climate. The proposed bioclimatic solutions and strategies were accurate and appropriate for this area. The research I have performed and the proposed solutions demonstrate that this project can be viable in coordination with the location in a natural environment and with limited energy resources as to provide a comfort area within the Project as well as in the surrounding exterior.

Figure 14: 3d images of the project

CONCLUSION

I choose the use of traditional construction system (concrete), using materials with a high thermal mass, including thermal inertia and isolation and pre-fabricated blocks and natural stones for the exterior spaces. The concrete is produced in Israel. It does not need transportation. According to the point system of "LEED" Green Construction Standard.

The proposed bioclimatic solutions and strategies were accurate and appropriate for this area. The research I have performed and the proposed solutions demonstrate that this project can be viable in coordination with the location in a natural environment and with limited energy resources as to provide a comfort area within the Project as well as in the surrounding exterior.

REFERENCES

1. Michael & Szokolay, Steven: Climate analysis. University of Queensland, Department of Architecture.
2. Atlas of Israel.
3. Programa Grafisol.
4. Palomo, Pedro Salvador (2005): La planificación verde de las ciudades. Ed. Gustavo Gili, Barcelona.
5. Morrillón Gálvez, David: Comportamiento térmico del edificio.
6. Morrillón Gálvez, David: Enfoque bioclimático del análisis térmico de edificios.
7. Godova, Sujata S., Dr.: Heat Storage in Buildings.
8. Higueras, Ester (2006): Urbanismo bioclimático. Ed. Gustavo Gili, Barcelona.
9. Houg, Michael (2004): Naturaleza y ciudad. Ed. Gustavo Gili, Barcelona.
10. Olygay, Victor (2002): Manual de diseño bioclimático para arquitectos y urbanistas. Ed. Gustavo Gili, Barcelona.
11. Evans, John Martin & Schiller, Silvia: Solar Design and Architecture Bioenvironment. Chapter on natural light. Previous edition, EUDEBA, Buenos Aires.
12. Fergus, J. Nicol & Humphreys, Michael A.: Adaptive thermal comfort and sustainable thermal standards for buildings. Oxford Centre for Sustainable Development, School of Architecture
13. Vital-Baron, Michal: Una guía hacia una construcción verde en Israel.
14. Municipio de Tel -Aviv-Jaffa.
15. Global Gazetteer, versión 2

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