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Green Architecture with an Example in Amman – Jordan

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Abstract
This Article Is about The principles of green architecture Adaptation to climate, such as Energy Conservation, Respect for the site, Respect for dealers and users, the inclusive design, and Global and Local examples of Green Architecture**,** with mention some recommendation about scarcity of rainwater and exploitation each of solar energy and wind power.
Keywords: sustainable building; environmental management; resource conservation; cost efficiency; human adaptation.

1. Introduction - Green Architecture

The world began to recognize the relation between economic development and the environment, the specialists paid attention that traditional forms of economic development is limited to over-exploitation of natural resources at the same time caused a lot of pressure on the environment as a result of what is produced from pollutants and harmful waste.

Hence appeared the concept of sustainable development, which is defined as "meet the needs of current generations without compromising the ability of future generations to meet their own needs".

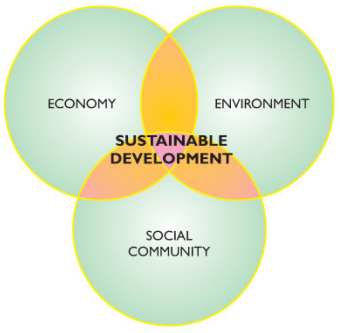
Most of the world has paid special care and attention in the last decade of the last century of environmental protection and sustainable development, this interest has been born out as result of loud voices calling for reducing the environmental impacts from various human activities and called for the reduction of waste and pollution and conserving natural resources for future generations base.

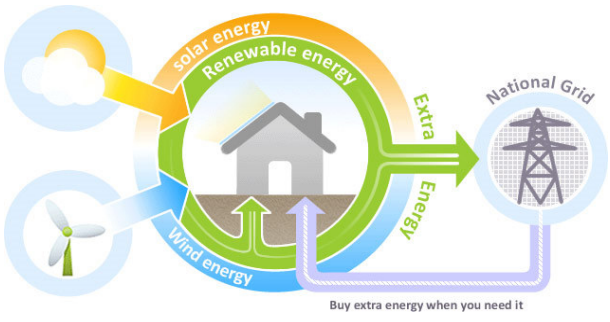
As a result, the urban sectors in this day and age is no longer in isolation from the pressing environmental issues that threaten the world was be noted in the last few years, these sectors on the one hand is considered one of the main consumers of natural materials such as land and materials, water and energy, on the other hand, the many and complex on structure industry operations produce large amounts of noise and pollution and solid waste.

The remaining problem of energy waste and water of the leading environmental-economic problems of the buildings due to the continuation and sustainability throughout the period of operation of the building.

Others added that the environmental management and control of construction projects will be one of the most important competitive standards in these sectors in the twenty-first century.

From here it originated in the advanced industrial countries new concepts and methods were not familiar before in the design and implementation of projects, and these concepts "sustainable design" and "green architecture" and "sustainable buildings", All of these concepts reflect the growing interest among the urban sectors and economic development issues in the light of environmental protection, and reduce energy consumption, and optimal utilization of natural resources, and greater reliance on renewable energy sources (Renewable Sources).





2.The concepts of sustainability and green architecture in the urban sector:

Sustainable design... Green architecture... Sustainable construction... Construction green... These concepts are a new methods for the design and construction conjures environmental and economic challenges that have cast a shadow on the various sectors in this day and age, the new buildings are designed, implementation and operation methods and advanced technique contribute to reducing the environmental impact, and at the same time lead to lower costs and, in particular, operation and maintenance costs (Running Costs),as they contribute to providing a safe and comfortable urban environment.

Thus, the emitters adopt the concept of sustainability in the urban sector is no different from the

motives that led to the emergence and adoption of the concept of sustainable development and environmental, economic and social dimensions overlapping.

There are no dividing lines between the environment and economy since the emergence and spread of the concept of sustainable development, which confirmed beyond any reasonable doubt that ensure the continuity of economic growth can't be achieved under the threat of environmental pollutants and waste and destruction of vital systems and the depletion of natural resources.

Green architecture promotes sustainable and adopt this close link between the environment and the economy, and the reason for this is that the effects of construction activities on the environment and buildings have economic dimensions and clear, and vice versa, Energy consumption, which causes a high electricity bill closely linked to the phenomenon of sick building arising from greater reliance on artificial air-conditioning with the neglect of natural ventilation, This speech applies to one relying on artificial lighting to illuminate the building from the inside, leading to increased electricity bill at the same time reduces the environmental and health benefits, As if the sun's rays enter at times in to the building. Recent research has shown that exposure to artificial light for prolonged periods cause serious damage to human health on the psychological and physical levels.

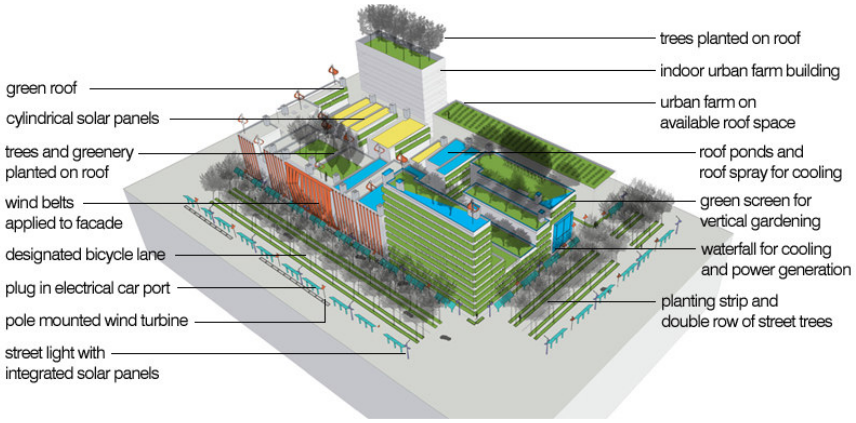
The exposure optical vibrations of the lamps lighting process(fluorescent) and lack of natural lighting of the most important negative effects suffered by the office work environment, has emerged as a result of numerous complaints from users in some of the advanced industrial countries, it included a sense of physical stress and fatigue, severe headaches and insomnia. The artificial lighting is considered severe at the forefront of the likely causes of the symptoms of depression in working environments.

The waste in construction materials during the implementation of the project is to create additional costs and at the same time lead to the pollution of the environment of these waste involving small amounts of non-toxic and harmful chemicals. Thus, the solutions to environmental and processors offered by green and sustainable architecture lead sat the same time to achieve the economic benefits are end lesson the individual and community level. According to some estimates, the worldwide construction industry consumes about 40% of the total raw materials and this consumption is estimated at about (three billion) tons per year. In the United States alone, buildings consume 65% of the total energy consumption of all kinds, and cause (30%) of the emissions of the green house.

The importance of integrating practices and applications of green and sustainable architecture is evident and clear, indicates where the architect James Lines in his book "green architecture" that buildings consume one-sixth of the water supply of fresh water in the world, and a quarter of wood production, and fifty fuel and materials manufacturers. At the same time, half of the gas produced harmful Glass House; He adds that the built environment space (built environment) in the world will double within a very short period of time ranging from 20-40 years to come.

These facts make the operations of the establishment and operation of urban buildings and one of the most energy-intensive industries and resources in the world. The pollution caused by the lack of buildings and waste issued by the efficiency is originally caused by bad design of the buildings, Contaminants and residues that cause significant damage to the environment is only incidental out puts (by-products) to the way the design of our buildings, construction, operation and maintenance, and when they become biological systems (bio-systems) is healthy as a result of these pollutants, it means there is not a safe environment for users.

The high cost of energy and environmental concerns and public concern about the phenomenon of "sick building" associated buildings, box closed in the seventies, all of which helped to bring about a jump start for the movement of green and sustainable architecture. At present, the "economy" is the motivation President to switch orientation and designs buildings greener. Architect Michael Kroozba (Michael Crosbie), who works in the office (Steven Winter Associates) points out in this regard that "customers who are interested in the design of much more than the demand for green buildings, because they see and realize the enormous amount of money that is spent for the sake of getting something built, and therefore they want rewarding return on investment for that."



Supporters of green and sustainable architecture are betting on the many benefits of this trend, in the case of a large office building - for example - the integration of green design methods **(Green Design Techniques)** and smart technologies (Clever Technology) in the building not only helps to reduce energy consumption and reduce environmental impact, but it also reduces the costs of construction and maintenance costs, And creating a pleasant and comfortable working environment, and improve the health of users raise their productivity rates, as it reduces the legal liability that may arise because of the sickest buildings, and raise the value of the ownership of the building and lease revenues.

Thus, the green trending the construction industry works to save energy costs in the long term. In a field survey was carried out on the (ninety-nine buildings) of green buildings in the United States found that they consume less energy (30%) compared with similar conventional buildings. Therefore, any additional costs to be paid in the design and construction phases can be restored quickly. Compared to this, the over-the traditional view to try to reduce the initial construction costs can lead to wasted materials and higher energy bills on an ongoing basis.

But the benefits of green buildings not just limited to the direct environmental and economic aspects, The use of natural day light in office buildings- for example-as well as it reduces the operational energy costs, it also makes workers more productive, have found the study conducted in Environmental Psychology the University of Michigan(by Rachel and Stephen Kaplan)that the views of the staff who are available to them on the natural areas of their offices showed greater satisfaction toward work, and they were less exposed to stress and disease was less. Also one working in the field of space companies (Lockheed Martin) found that the absenteeism rate fell by 15% after the transfer (2,500 employees) to the newly green origin of a building in California, the economic payoff for this increase in offset additional amounts spent productivity rate during the construction of the building in one year only. By similarly, the use of natural daylight in shopping centers leads to raise the volume of sales, the Advisory group specialized in efficient buildings technologies in energy (Heschong Mahone), based in California, found that sales were higher by 40% in the marketing stores that has lit through openings roof (Skylights). The group also found that the performance of students in the lesson lit halls naturally better (20%).

3. The principles of green architecture:

The Green Building foundations and principles of the view of some experts, and should not be viewed as a fixed menu must be applied by designers as a whole when the determination of the buildings, but are considered as indicators and trends contain some ideas and solutions to call Windows as much as them also noticed it in practice difficult to separate quite often between the principle and the other, there is no doubt that there is overlap and sometimes correlation between these principles and to each other, and the principles of green architecture are:

Energy Conservation :

The building must be designed And it built in a manner which reduce the need for fossil fuels and rely more heavily on natural energies, and in the report of the Department of Energy in the United Kingdom in 1988 proposed to be 50% of the adoption of the Kingdom in the energy consumption of renewable energy resources, such as solar, wind and waves and live bloc energy and water, In 1979, the International Institute for Environment and Development study included a detailed examination of the various economic sectors in the United Kingdom showed how you can reduce the overall energy demand by 22%, while the per capita standard of living income level can become a weakness, while for the research body the earth's resources ERR that by 2025, 60% of the energy must contain a renewable energy. One of the means of reducing energy consumption appears to increase the home appliance efficiency such as ovens and air-conditioners that consume less

electricity, and can reduce the consumption of electricity using solar photovoltaics that produce electricity directly from sunlight, and with the continuing decline in solar cell prices, integrated directly in the interface or roof Paste the building instead of a separate solar panels become possible soon circulated, it has been able to a German company (Flachglas company), one of the large companies for the manufacture of glass from the integration of solar cells in a half-transparent glass windows and light, which supplies the place candidate during generated electricity.

Adaptation to climate :

You must adapt the building with the climate and the various elements, at the moment of ending the construction becomes part of the environment, like a tree or a stone, and it becomes an exhibition of the same effects of the sun or rain or wind as anything else is in the environment, if managed the building that faces the pressures and climatic problems and at the same time using all climatic and natural resources available in order to achieve human comfort inside the building could be called on this building as a balanced climate.

The climate control problem and create a suitable atmosphere for human life as old as humanity itself, it has the keenness of bright that includes built to shelter two main components: protection of the environment, and try to find an internal atmosphere suitable for rest, has the opposite building design and composition throughout history proper different solutions for each are to achieve this goal, So we find that the ice house (in the areas of Eskimos, for example) the outside is formed by a distinctive and the formation of internal his spare provides living in a high place where hot air gather for heating away from climate snow bitter cold outside and the style is simple, and in contrast find housing with the inner courtyard is cool air at night stores to face severe during the day in the hot dry climate of heat, while the overall composition of the block housing the tropical to facilitate the movement of air through works which helps to get rid of high humidity, which works to increase the burning sensation, All of which are innate architectural styles used by them to resist the harsh climate, these methods are the product of interaction between the two main components: The first is the natural wealth of raw materials, and the second is the climate prevailing in the region, in the presence of certain activities engaged in and around these buildings in the framework of a social structure affects the methods design. The emergence of industrial energy sources and the development of modern construction methods to the development of architectural Formation and freedom in design, which led to the possibility of using the large plate glass sometimes up to cladding and building facades entirely glass, and became the architectural designs are similar in all countries despite their different climatic conditions of the other region in the world. Half of the energy used in the operation and construction of any building geared to produce an internal industrial climate, so the potential savings from designs based on the use of natural energies to do the same purposes may constitute a very large amount, from here, the design that takes into account the climate may be the best way to reduce the negative environmental impact most modern buildings. One of the benefits of the construction of appropriate buildings for climate is the way that makes us rely on nature again, as to the appropriate buildings for climate may help to create a suitable climate people, and the benefits on families from an apartment appropriate for the environment of houses belonging equally to workers in the buildings take into account the surrounding environment out, it has lent the use of light and natural ventilation industrial and light that can be tuned depending on the desire of her employer an atmosphere of joy and gave employees a greater opportunity to control the environment around them.

Respect for the site

The primary goal of this principle to set the building on land in style does not work to bring about fundamental changes in the site from an ideal viewpoint that if the building has been removed from his position or move, then the site back forerunner condition before it is creating the building. The tents nomads latest most important expressions of this principle examples, these tents are woven from the hair of sheep, camels and is supported and installed some wooden pegs and ropes only, and at the departure of Bedouin to other places in search of pasture to graze their sheep we note that there are no significant changes location. The principle of respect for the site call for designers to use the methods and ideas of design that would cause the least possible changes construction site, especially in drilling operations or back fill or grab some trees from their places, as it is an invitation to use a special light installations in temporary buildings or in own nature tourist areas

Respect for dealers and users

If the Green Architecture pay attention to the cause of conservation of energy and resources as alert the designers of the importance of respect for the environment in general, there is no doubt that it gives more attention to its clients, whether they are workers or users, safety of human and keep it is the ultimate goal of her.

The inclusive design

All the principles of green architecture must be taken into account in an integrated manner during the design of

the building or the city planning process, and may be difficult to achieve in practice all the above principles, but with careful study and careful alongside convinced this community thought it would not be impossible. Windcatcher used to ventilate closets confrontation is directly in terms of the prevailing winds or to ventilate the basement (basements), while the use of wood mashrabiyya interfaces helped to break the unity of the sun's rays while providing privacy factor.

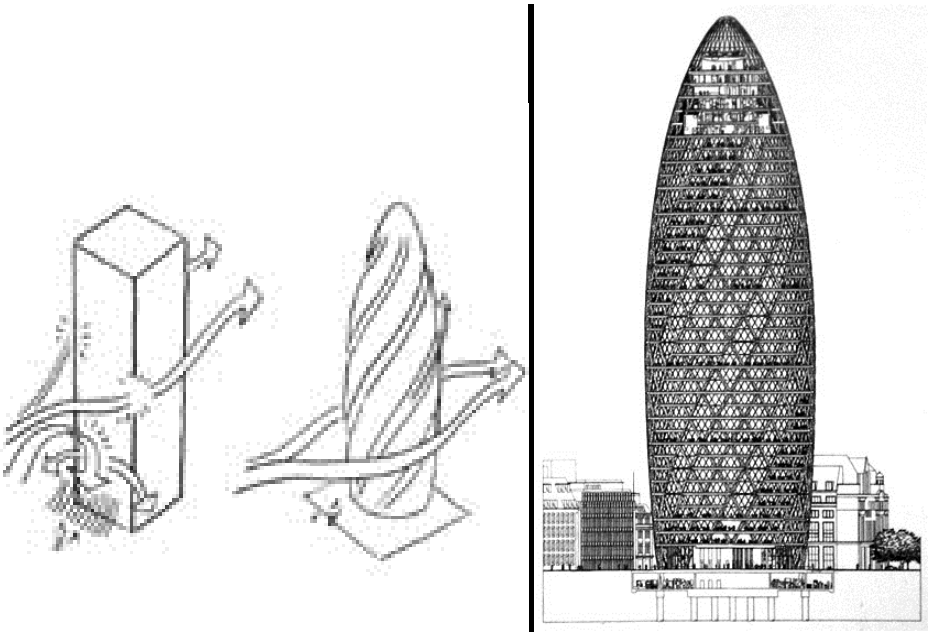
4. Global examples of Green Architecture

When reflecting on the strict environmental conditions of our limited resources we need to realize that the applications of green architecture and sustainable construction is more advanced industrial countries. If the sun and heat, and its flame amount in our region of the highest in the world, this means that there is a golden opportunity to employ them an alternative source of energy production, as well as to exploit the lighting of buildings and facilities during the daylight hours. However, we hear about buildings facility in some countries that absent the sun for long days in the year, and these buildings are based mainly in the interior lighting on natural daylight, providing half the amount of energy consumed in lighting, while we see our buildings that lie under the hot sun and glare optical light dark and dim strong inside and just depend on artificial lighting that add economic burdens to the electricity bill, but that those countries severed advanced strides in the exploitation of solar energy as an alternative energy in buildings as a source applications, in addition to the use of wind and water falls in the production of energy.

There in industrialized countries many large buildings that embody the concept of green and sustainable architecture that minimizes impacts on the environment, including the Tower Building (**Conde Nast**), consisting of (48-storey) in Times Square in New York, designed by (Fox, foul Architects).

It is one of the early examples that have applied the principles of sustainable green architecture in the large urban building, which has almost used all the techniques imaginable to save energy.

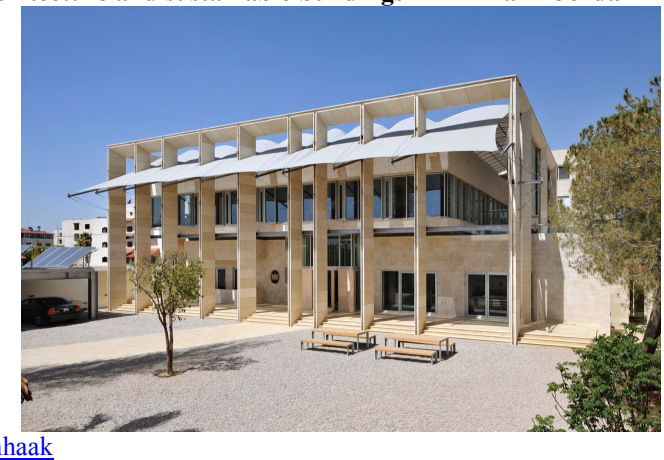
The building was used a special glass let in natural sunlight and keep the heat and ultraviolet radiation outside the building, and reduce internal heat loss during the winter. There are also two cells working on fuel were supplying natural gas to the building (400 kW) of power, enough to feed the building with all the amount of electricity needed for the night, in addition to (5%) of the amount of electricity needed by the day. The exhaust hot water was produced by fuel cells used to help heat the building and provide hot water. While developed cooling systems and air-conditioning on the ceiling as a generator rather than a gas generator, this reduces the energy loss associated with power transmission. The panels (Photovoltaic Panels) located on the exterior of the building provides the building of additional capacity of up to (15 kW). And inside the building controls movement sensors fans and blew out the lighting in a few areas such as stairs occupancy. The exit signs are illuminated light polychlorinated reduced energy consumption. The end result is that the building consumes less energy by (35-40%) compared to any similar traditional building.



Other examples of green tower architecture (**The Swiss Re Tower**) that lies in one of the streets of the City of London and designed by architect Norman Foster and Partners, refers Londoners for this architectural edifice as the newest addition to the skyline of their city-honored line, and the tower erect a fruit option consists of (41 stories), but the wonderful thing about this building is not beautiful architectural form, but his efficiency in high energy consumption, the design is creator and creative to achieve expected savings in energy consumption up to 50% of the total energy consumed by a traditional building similar. And it sang the building reflected the benefits of energy saving in the use of natural lighting and natural ventilation to every possible thing. The front of the building is made up of two layers of glass (external ones is a double glass), and the layers surround the cavity airy curtains directed by computer. The weather sensors located on the exterior of the building system which monitors the temperature and wind speed and the level of sunlight, to close the curtains and windows open plates when needed. The shape of the building is designed to increase the use of natural daylight, and reduces the need for artificial lighting, and allows viewing normal external views even to those who are in the depth of the building from the inside.

The most famous building green is temporarily located on the "drawing board" until the completion of the stages of its inception and is the Freedom Tower, which will be built at the former site of the World Trade Center building in New York. Designers and architects (Skidmore, Owings & Merrill and Studio Daniel Libeskind) integrate environmental design in all parts of the huge advantages of the building. And will contain the tower, which will rise President (1.776 feet) of solar panels in addition to wind power station (working on wind), the turbine is expected to generate about (1 MW) of energy, which is enough to feed the tower (20%) of expected it needs energy . Like other green building, the tower will depend on the natural lighting and ventilation, in addition to the elements of lighting systems and high-efficiency in energy consumption.

5. Example of green architecture and sustainable buildings in Amman - Jordan

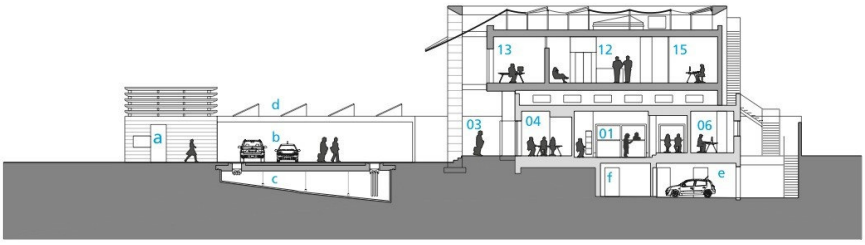


Architects : Rudy Uytenhaak
Location : Amman, Jordan

Design Team : Fumi Hoshino Frank Langhorst, Felix Reiter, Jaap Hikke, Sebastian Sterniak
Client : Ministry of Foreign Affairs
Contractor : Consolidated Consultants, Amman
Installations : Royal Haskoning
Area : 1000.0 sqm
Project Year : 2010
Photographs : Pieter Kers

Amman is a fast-growing city entirely made up of buildings in local natural stone: not only the well-off neighborhoods but also poorer districts, and not only homes but also offices, hotels, museums and shops.

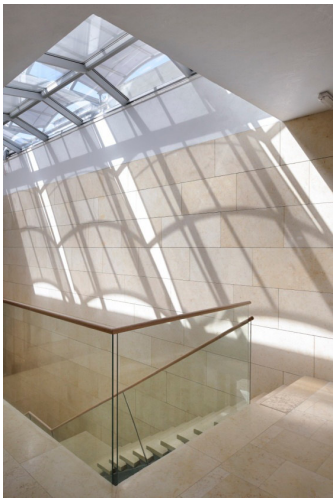
The Dutch embassy project concerns the renovation of an understated villa within a walled garden. The building was renovated and extended because it was too small, and not earthquake-proof. Hospitality in combination with security formed the essence of the design brief. The entrances and the various consulate functions are situated on the ground floor in the original building layer, while a separate new structure above this houses the more representative section of the embassy. The building as a whole is given a unified character by a light-filtering portico made of local Jerusalem Stone. This framework emphasizes the relation with the garden and shades the building from the heat of the sun, so the embassy staff can enjoy the attractive views of the garden without the discomfort of excessive heat. Intended to express both hospitality and security, the portico rising above the enclosure wall forms the new public face of the embassy. As symbolic as the Acropolis in Athens, or modern interpretations of the temple and agora such as Oscar Niemeyer's Mondadori building in Milan, but now expressed in the structural vocabulary of Amman: classic modern architecture as a new and contemporary image, adapted to the local context of building traditions and climate. The rhythm of the columns originates in the interplay of the dimensions of the elements of the original villa's structure as well as computer simulations of their function as sunshades.

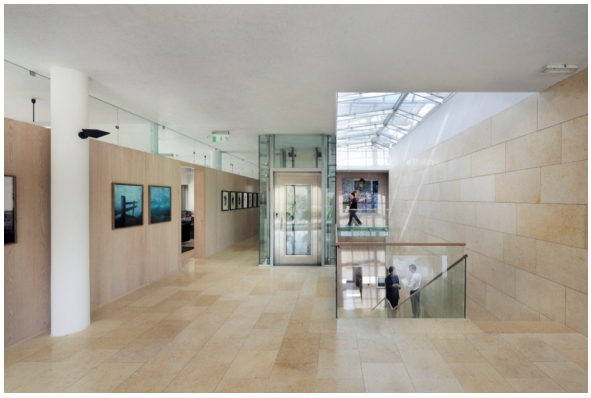


cross-section

a	guards house	01	entrance consulate	11	void/hall
b	parking	02	reception area	12	lounge
c	former pool	03	entrance	13	office
d	solar collector	04	multi-purpose	14	terrace
e	parking	05	hall	15	clerk
f	archive	06	office	16	archive

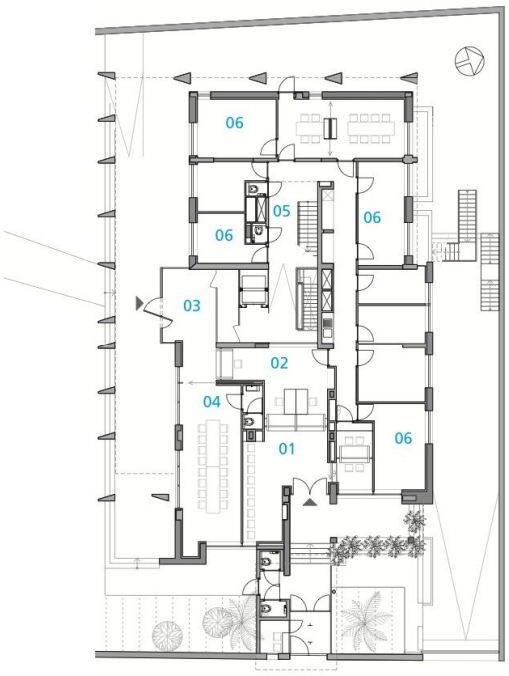
Sustainable installations for a temperate microclimate , Photovoltaic cells, solar panels, rainwater storage





A sustainable installation concept for the building has been developed in partnership with installation consultancy firm Royal Haskoning Nederland

On the awning roof and the south portico, solar panels and parasol sails catch the sunlight. The eastern parasol sails can be shifted towards the terrace when the harsh morning sun shines directly onto the facade, but also in winter, so that the building can be warmed if required.



ground level

01 entrance consulate
02 reception area
03 entrance
04 multi-purpose
05 hall
06 office

The original swimming pool is reused as a water buffer for the storage of heat/cold from the solar collectors above the parking places. During the day the building is cooled using this energy. In the winter, in contrast, these panels collect heat, so the temperature differences between day and night can be moderated. A heating circuit for this purpose has been incorporated in the embassy's floors. Fifty percent of the awning roof is made up photovoltaic cells, enough for all the building's electricity needs. The remainder of the roof area is fitted with sails to shade out the sunlight, so its heat is captured and ventilated away. Rainwater is also captured. Because of these measures, as well as the use and re-use of local materials, the building has been certified under the LEED Green Building Rating System. A silver rating is already assured, and a gold rating seems possible, making this the first building in Jordan and the first Dutch embassy to receive such an award.

6.Conclusion and recommendations :

That the activation of the application of the concepts and practices of sustainability and green architecture in the construction industry cannot be done only by architects and engineers qualified in this area, which will lead to finding appropriate solutions to environmental, economic and functional problems. The "green architecture", "sustainable buildings" is not a luxury academically, nor a trend in theory and aspirations and dreams have no place in reality, but it represents a trend applied universally and professional practice and conscious began to take shape features and dimensions significantly among architects and engineers involved in sectors of construction in the advanced industrial countries . These countries have come a long way in this area and there is a marked increase in the popularity of this trend by the public in light of continued interest by the professionals themselves. Valm Marion and engineers are as effective tools that can localize these techniques and establish it a professional practitioner during building design projects and supervise their implementation. This in turn requires attention to architectural and engineering education in our universities so that they become the faculties of Architecture and Engineering "incubator" approach to green architecture and sustainable buildings.

From the professional perspective, in order to create environmental and economic solutions to the problems faced by the construction sector we urgently need to change traditional patterns used in the design and implementation of our buildings more sustainable to make them, and this change is required must start from the element president in the construction industry operations and is the architect designer, the means of bringing about this change, as we have said, it stems from the educational process in the colleges of architecture, engineering, and continue during the practice through continuing education, vocational training and rehabilitation in this area.

For that we would suggest some Recommendations:

- Jordan considered one of the countries of scarcity of water, and is classified among the poorest five countries in the world's sources of water available especially for the purposes of potable water and agriculture, due to the location of Hashemite Kingdom of Jordan in arid and semi-arid lands, which is characterized by low rainfall, which is the main source to feed water sources.
- Rising cost of energy and building materials, and the economic challenges experienced by Jordan, as well as negative impacts on the environment, requires us to make wider use of alternative energy sources, and develop techniques to reduce energy consumption in addition to develop materials and new methods of design, implementation, operation and maintenance
- The national strategy for the energy sector, which came to achieve the overall objectives to meet the challenges of the energy sector in Jordan and the long-term strategy which was approved in the Council of Ministers at the end of 2004, namely to :

♣ Raise awareness on the rationalization of energy consumption.
♣ The establishment of offices to serve the public in order to reach all segments of the citizens and make them aware of the rationalization of energy consumption and improve efficiency.
♣ Exemption for energy-saving equipment from the Sales Tax and customs.
♣ Implementation of procedures related to the rationalization of energy consumption in the transport sector strategy.
♣ Development of an effective mechanism for the application of thermal insulation codes.
♣ The development of a national award in the field of energy conservation in the Kingdom

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