

New Egypt with a New Hybrid Skin “A New Hybrid Architecture Vision for the Egyptians` Development Corridor”

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Abstract

After the 25th of January revolution, Egypt was looking for a national project combines the energies of its young generations and draws a new image for Egypt.

The development corridor for Farouk el Baz which aims to provide numerous opportunities for the development of new communities, agriculture, industry, trade and tourism around a 2,000 km strip of the Western Desert, Became one of the current national projects.

This development corridor includes the establishment of a superhighway to be built using the highest international standards, 1,200 km in length, from west of Alexandria to the southern border of Egypt, Twelve east-west branches, with the total length of approximately 800 km, to connect the highway to high-density population centers along the way, A railroad for fast transport parallel to the superhighway, A water pipeline from the Toshka Canal to supply freshwater, and An electricity line to supply energy during the early phases of development.

So, what would be the architecture of the new Egypt? How to avoid the current mistakes and problems in the existing urban environment?

The new hybrid architectural skin is one of the suggested proposals for the new Egypt, and it means designing **an eco-friendly, energy efficient Buildings qualified for LEEDs and Energy Star ratings**. It also means, using technology and natural materials to create a healthy living urban environment.

The research will come out with different scenarios for the new Egypt hybrid architecture and its guidelines.

Key Words: Egypt development corridor, eco-friendly Architecture, Hybrid systems

1. Introduction

After the 25th of January revolution, Egypt was looking for a national project combines the energies of the Egyptians `generations and draws a new image for Egypt.

Farouk El Baz addressed the development corridor as a national project aims to provide numerous opportunities for establishing and developing new communities, agriculture, industry, trade and tourism in the western desert of Egypt. This encourage the researcher to think of the image and the theme of such new communities based on analyzing the current urban problems and the meaning of designing a sustainable city through the analysis of Masdar City in Abu Dhabi. finally, the research will come out with different guidelines for establishing a new hybrid sustainable cites in Egypt.

2. Egypt development corridor

A visionary plan for a “Desert Development Corridor” in Egypt, researched and created by Boston University geologist Dr. Farouk El-Baz. El-Baz’s idea has two components: first, an axis composed of a north-south running eight-lane highway, a high-speed train, an electricity line, and a water pipeline for human consumption along the 1,200 kilometer strip of desert. [1] Its distance from the Western scarp of the Nile Valley varies from 10 to 80 kilometers, based on the nature of the crossed land.; and second, 12 east-west axes (branches) Twelve branches are taking the responsibility of connecting the main cities of Egypt with the North-South Highway as seen in (figure 1)

The project would cost approximately \$24 billion.

1. Alexandria Branch
2. Delta Branch
3. Cairo Branch
4. Faiyum Branch
5. Bahariya Branch
6. Minya Branch:
7. Assiut Branch
8. Qena Branch
9. Luxor Branch
10. Kom Ombu-Aswan Branch
11. Toshka Branch
12. Lake Nasser Branch

Egypt Development corridor

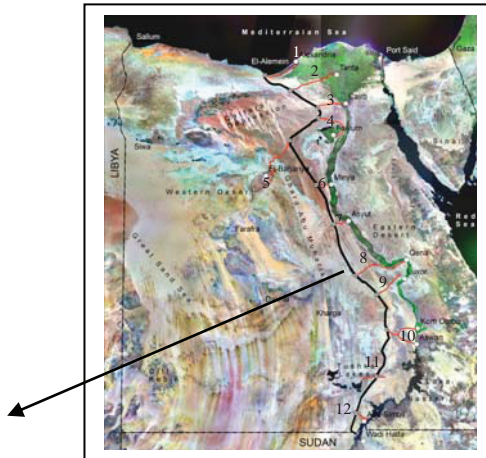


Figure1: shows the development corridor primary plan [2]

Each branch has a theme or more depending on the potentials of its location. For example Lake Nasser Branch will depend on agriculture and fishing expansion.

3. Egypt Urban Problems

Egypt new cities planning visionary is depending on achieving three major factors which are: housing, jobs and services to satisfy the human needs but that is not enough ,as Egypt has several environmental

problems drawing a big challenge for its future like; the increasing of air, water and soil pollution, consumption of the non-renewable energy and Water problems with the Nile Basin countries.

The research will address quickly those problems and how to reflect the environmental aspects in the authorities visionary planning as below:

3.1 The Increasing of Air, Water and Soil Pollution,

The fast increase in air, water and soil pollution in Egypt has become a real threat to the people's health.[3]

The air quality in downtown Cairo is more than 10 to 100 times of acceptable world standards.[3] Cairo has a very poor dispersion factor because of lack of rain and its layout of tall buildings and narrow streets, which create a bowl effect (bad ventilation of pollutants so that we will be affected dangerously as this pollutants cannot escape). The Main Air Pollution Problem in Egypt is the particulate matter. The most notable sources of the dust and small particles is transportation on, industry and open-air waste-burning! Another significant source is the windblown from arid areas around Egypt (e.g Western Desert). The air in Egypt is very thick, gray and there is a haze over Cairo. Furthermore, other forms of air pollution in Egypt are: sulphur dioxide (SO₂), nitrogen dioxide (NO₂) in urban areas. As well as carbon monoxide (CO) in streets, due to the excess amount of cars exhaust and factories pollutants. The sky is not blue but gray, Very similar to Mexico City and Bangkok. [4]

3.2 consumption of the non-renewable energy

Egypt consumed much of the energy it produced figure [3, 4] and had to import coal, highlighting the limited importance of Egypt as a global energy producer.

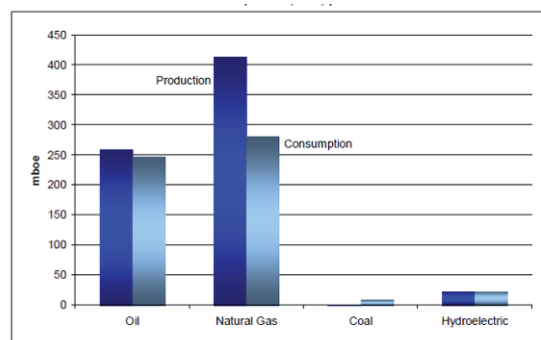


Figure 2: Egyptian Primary Energy Consumption and Production [4]

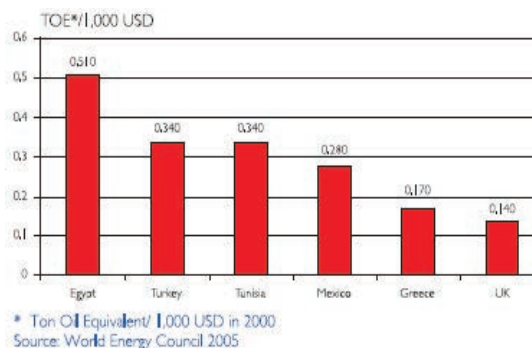


Figure 3: Ton of Equivalent/ 1.000USD in 2000 [4]

According to Egypt Modernization Centre website, 95% of the current national energy supply mix in Egypt is coming from fossil fuel (petroleum products and natural gas) 5% from renewable resources (mainly hydro and wind, which is increasing gradually).

The electricity generation activity utilizes around 30% of the fossil fuel and natural gas resources in addition to all the hydro and wind energy resources.

3.3 Water problems with the Nile Basin countries.

In 1979, Egyptian President Anwar Sadat said: “The only matter that could take Egypt to war again is water.” [5]

Egypt Shared the River Nile with other 9 countries which are: Burundi, Eritrea, Ethiopia, Kenya, Rwanda, Sudan, Tanzania, Uganda, and the Democratic Republic of the Congo.

Conflict over the Nile’s waters is currently existing making the situation is more complex and harder to address instability into the surrounding areas.

This conflict will cause a big disaster for Egypt not only because of water considers an essential element for life but also because Egypt is depending completely on the River Nile as a key component of the Egyptian electricity system through the high dam for 40 years now.

This is why the Government of Egypt (GOE) has set a strategy to implement a number of policies up to year 2022

- Draft laws to improve the energy efficiency, encourage the use of renewable energy and replace and limit the use of energy consuming equipments.
- Programs for exchanging experience at the industrial level in the field of energy rationalization, with some scientific agencies working in the field of energy efficiency. [5]
- Coordination with the Committee on Electricity Rationalization of the Cabinet and the Supreme Council for Energy.

3.4 Climatic Change Problem

Last year the researcher worked on a research about the threats of the sea level rise on the Nile Delta which will cause the migration of millions of people from their homes to another places.

After addressing all the above threats, how Egypt is going to meet the upcoming challenges concerning the energy consumption?

How to plan a healthy, cleaner and sustainable future?

4. Sustainability and Sustainable City Principles

Sustainability means, meeting the needs of the present without compromising the needs of the future generations.

A sustainable society does not rely extensively on non-renewable resources as a basis for its economy. It reduces the consumption of renewable resources to levels that can be replenished by nature. [6]

5. Hybrid Architecture Skin

The new hybrid architectural skin is one of the suggested proposals for the new Egypt, and it means designing **an eco-friendly, energy efficient Buildings qualified for LEEDs and Energy Star ratings**. It also means, using technology and natural materials to create a healthy living urban environment. For decades in Egypt planning a new city means affording housing, jobs and services for the inhabitants (**Traditional City Planning = Housing+ Jobs + Services**)

But what the research is trying to mention, there are other important dimensions like energy and technology should be taken in to consideration when designing the new cities.

(Hybrid City Planning= Housing + Jobs+ Services+ Environment+ Technology)

6. Masdar as an Example for a Hybrid Architecture Skin

Masdar Abu Dhabi is a global hub designed by Norman Foster as a sustainable, zero carbon city with the highest quality of life for the purpose of research, development and production.

Masdar is currently constructed 17 km south-east the city of Abu Dhabi and planned to accommodate 45,000 to 50,000 people and 1,500 businesses in addition to 60,000 workers are expected to commute to the city daily.



Figure 4: Masdar Site planning [7]



Figure 5: shows the sustainable city vision [7]

Masdar injected the 7 main items which are (urban planning, architectural design, construction, water, power, waste, transportation and integration) that reform any city with sustainable aspects.

The wide mosaic that comprises Masdar City's sustainability includes: Low-carbon cement, Smart utility grids and appliances, Highest-quality building insulation, advanced waste and wastewater treatment, Recycling and reuse systems, Smart appliances, meters, buildings and grid to manage and monitor water and electricity use and wastage, Modern windrowers to collect cooler upper, Breezes and direct them downward to the public, squares below, Intelligent use of shading to reduce solar gain, A Material Recycling Centre for construction waste, Well-shaded pedestrian colonnades, Some buildings' exterior walls covered in blocks of cushion-shaped.[7]

As previously reported on Carbound, Masdar City –is currently under construction and is due to be completed in 2016. As the the first zero-carbon emissions and zero-waste city, the master plan for Masdar City integrates many passive design and planning strategies with renewable energy production to achieve its ambitious sustainability goals.

At the center of Masdar City lies its first building, the Masdar Headquarters, which will become the research case study.

7. Masdar Headquarters

Masdar Headquarter was designed by Adrian Smith + Gordon Gill Architecture ,inspired by the rigion architecture and won several international awards.

One of the key distinguishing features of the building is it high-performance “sawtooth” facade that allows access to daylight and views while mitigating glare and solar heat gain. The design of the wall orients the highest-transparency vision glazing (windows) toward cardinal north or south, where daylight is at its highest angles and can best be redirected into the interiors; the east- and west-facing nonvision glazing features a 16.44mm thick insulating unit. This façade will result in more daylight, better views, a lower cooling load and increased energy generation. The sawtooth facade is also more structurally sound and sustainable than alternatives, reducing the structural steel required for mullions.

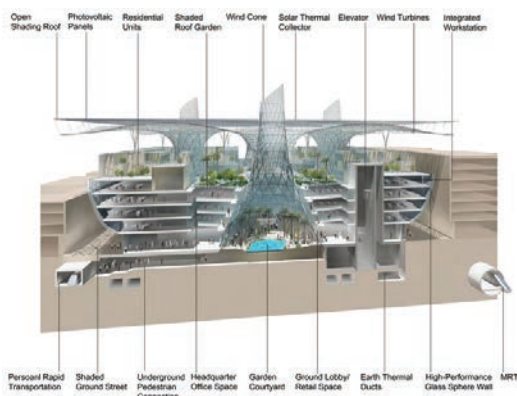
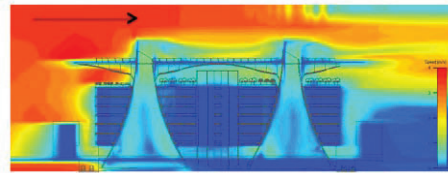


Figure 7: Rendering of Masdar HQ. Copyrights: Adrian Smith+ Gordon Gill



The building consists of 11 wind cones that provide natural ventilation and cooling. These cones also maximize the daylight diffusion inside the building. Also the building contains outdoor and indoor green spaces. The headquarters for Masdar will also be a centre of global renewable energy policy as home also to IRENA. With nearly 150 member states [8]

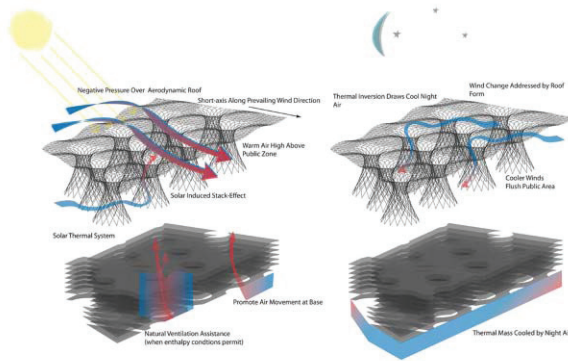


Figure 9: Natural ventilation strategy through wind cones during the day and at night. Copyrights: Adrian Smith + Gordon Gill

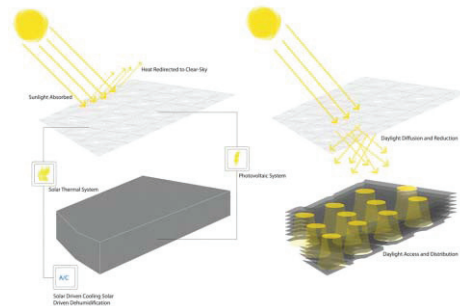


Figure 10: The roof canopy as a shading element and a solar collector. Copyrights: Adrian Smith + Gordon Gill

7.1 Active and passive Systems

In addition to passive strategies integrated into the building design, the design also employed a number of efficient active systems to cool and ventilate the building, including ground source cooling, an efficient under-floor air distribution system integrated into office furniture, and the world’s largest solar thermal driven cooling and dehumidification system on the roof canopy (Figure 11).

The design also features the use of integrated renewable energy generation, such as integrated wind turbines and the world’s largest integrated Photovoltaic systems, both mounted on the roof canopy. The installation of these renewable would help bring the building from a net energy user to a net energy

producer that produces 3% more than it consumes, thus creating a building that is not only carbon neutral but carbon negative.[8] (Figure 12).

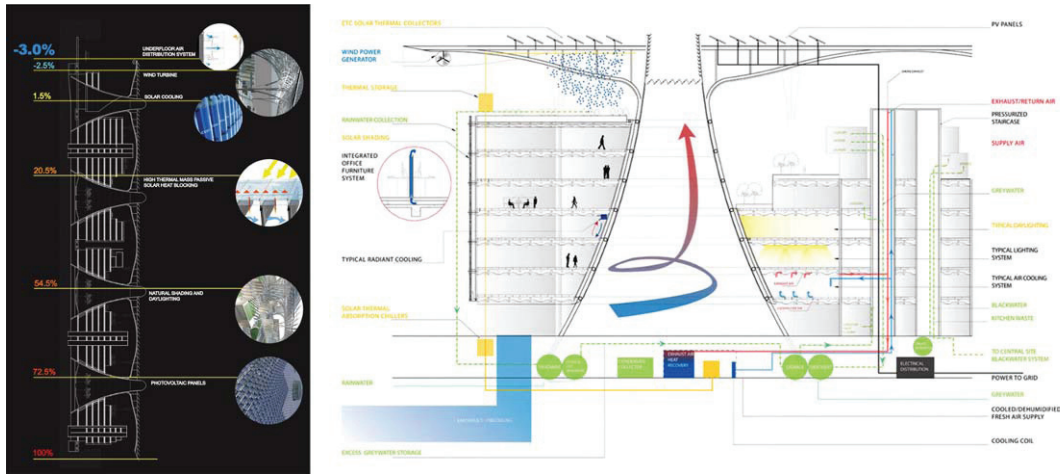
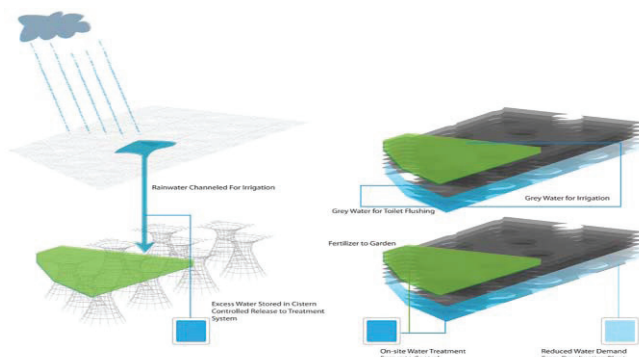


Figure 11: (left) Accumulative energy savings from the integration of passive strategies, active systems, and renewable. Figure 12: (right) detail diagram showing integration of active strategies into building. Copyrights: Adrian Smith + Gordon Gill

7.2 Water Conservation

As previously noted on Carbon, the Middle East’s water scarcity makes the need to implement water conservation strategies just as important as energy conservation. At Masdar HQ, a water conservation strategy is employed to save 70% of the building’s water use compared to a typical mixed use building of the same size. Rainwater and condensation are collected, stored, and used -together with grey water from showers, laundries, and lavatories- to irrigate the shaded roof garden.[8] Grey water is also used to flush toilets. Black water from toilets and kitchens is also used as a biofuel for diesel engines after treatment at the city’s black water treatment centre (Figure 13).



7.3 Mater

Materials used in project team call architects, the ex

Figure 13: The roof canopy water collection strategy and its integration with grey water recycling. Copyrights: Adrian Smith + Gordon Gill

frame and upper 1000 1000 1000, and the 1000 canopy and comes superstructure 1 / 70.

The external facade assembly was determined by analyzing 6 facade alternatives in terms of their embodied CO2 as well as their U-value and thermal performance. The embodied energy (or CO2)

impact .In addition, ding to the and CO2, the

score of each alternative was weighed against its use performance score to determine the most sustainable assembly. [9]

From all the above analysis Masdar gave the researcher different ideas and guidelines for how to establish a zero carbon, environmentally friendly city.

8. Discussion

Egypt has different Opportunities and Energy Potentials to change its planning vision from being traditionally into hybrid one reflects the understanding of the non-renewable energy crisis.

So, updating the renewable resources in Egypt such as wind, solar energy and Egypt Nuclear sector is very important and essential for the future of the upcoming generations.

9. Conclusion and Recommendations

From all the previous data analysis the researcher extracts different guidelines as recommendations for urban planners, authorities and the designers as follows:

- 1) Moving towards sustainability will require a new consciousness and commitment to do things differently than usual. It will require the City to:
 - develop new programs and/ or change existing programs
 - establish new priorities,
 - commit resources to sustainable causes, and
 - collaborate with other jurisdictions within the region to achieve sustainability.[6]
- 2) Before starting a new project further environmental studies should be done such as: the Environmental pollution and The Environmental Impact Assessment.
- 3) Increasing the environmental awareness between Egyptians through education and mass media.
- 4) Develop the building standers and laws to include the environmental assessment as major demand for building procedures.
- 5) Develop recognizable Low-impact durable materials from local sources as symbols of products that can be used by all in the process of design, construction and buildings.
- 6) Increasing the vegetations in the indoor and outdoor spaces.
- 7) Sustainable waste management through improving water treatment and waste handling & treatment.
- 8) Reducing energy and water consumption through, Building regulations , Reduced irrigation water demands; Solve photovoltaic electricity generation in Egypt, The promotion of sustainable development principles in all future, Maximized use of microclimatic effects to enhance external thermal comfort, [10]_Maximized water efficiency and reduced water consumption across a development, Maximized energy efficiency and reduced carbon emissions across a development.
- 9) Encourage the development of design sustainability standards by individuals, research centres and private sectors.

Finally, the change in Egypt`s supreme should have a significant direct impact on the planning vision in Egypt.

Reference

- [1] Farouk El-Baz, Development corridor ,interview , <http://blogs.bu.edu/professorvoices/2011/03/01/development-corridor/>
- [2] Farouk El-Baz's, 2007, "Development Corridor: Securing a Better Future for Egypt", http://faroukelbaz.com/index.php?option=com_content&view=article&id=22&Itemid=34
- [3] http://en.wikipedia.org/wiki/Environmental_issues_in_Egypt
- [4]: Source: BP Statistical Review of World Energy 2010, :
<http://www.bp.com/sectiongenericarticle.do?categoryId=9033088&contentId=7060602>.
- [5] Water, Conflict, and Cooperation: Lessons From the Nile River Basin, By Patricia Kameri-Mbote, 2007
- [6] "Creating A Sustainable City", A Master Plan to Move the City of Sacramento Towards Sustainability
- [7] Source: The Global Centre of Future Energy, Masdar city,
http://www.masdarcity.ae/userfiles/files/brochures/brochure_masdar_city.pdf
- [8] Carboun, "Abu Dhabi's Masdar Headquarters", 2010, <http://www.carboun.com/sustainable-development/sustainable-design/masdar-headquarters-the-first-positive-energy-building-in-the-middle-east/>
- [9] http://www.masdarcity.ae/userfiles/files/brochures/brochure_masdar_city.pdf
- [10] <http://dot.abudhabi.ae/download.do?loc=stmp/&file=PlanAbuDhabi2030.pdf>
<http://www.imc-egypt.org/pgmenergy.asp> "مركز تحديث الصناعة" Energy Efficiency, Renewable Energy and Environmental Protection"